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ABSTRACT

This guide is designed to assist postsecondary and secondary teachers of agriculture in their use of the University of Wisconsin bulletin "Raising Dairy Replacements" in their dairy science instructional program. Eight lessons are provided in this unit: breeding decisions, management of cows from breeding to calving, care at calving time, the newborn calf (birth to weaning), feeding calf starters, calf management jobs, keeping calves healthy, and replacement housing. Each lesson contains a performance objective, a listing of teaching-learning activities (including technical content), a list of supplemental material (including transparency masters, slides, and lists of references), and check-out activities with answer keys. An appendix contains transparency masters. (YLB)

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Teacher's Guide

Feeding & Management of Dairy Calves & Heifers

Walt Bjoraker

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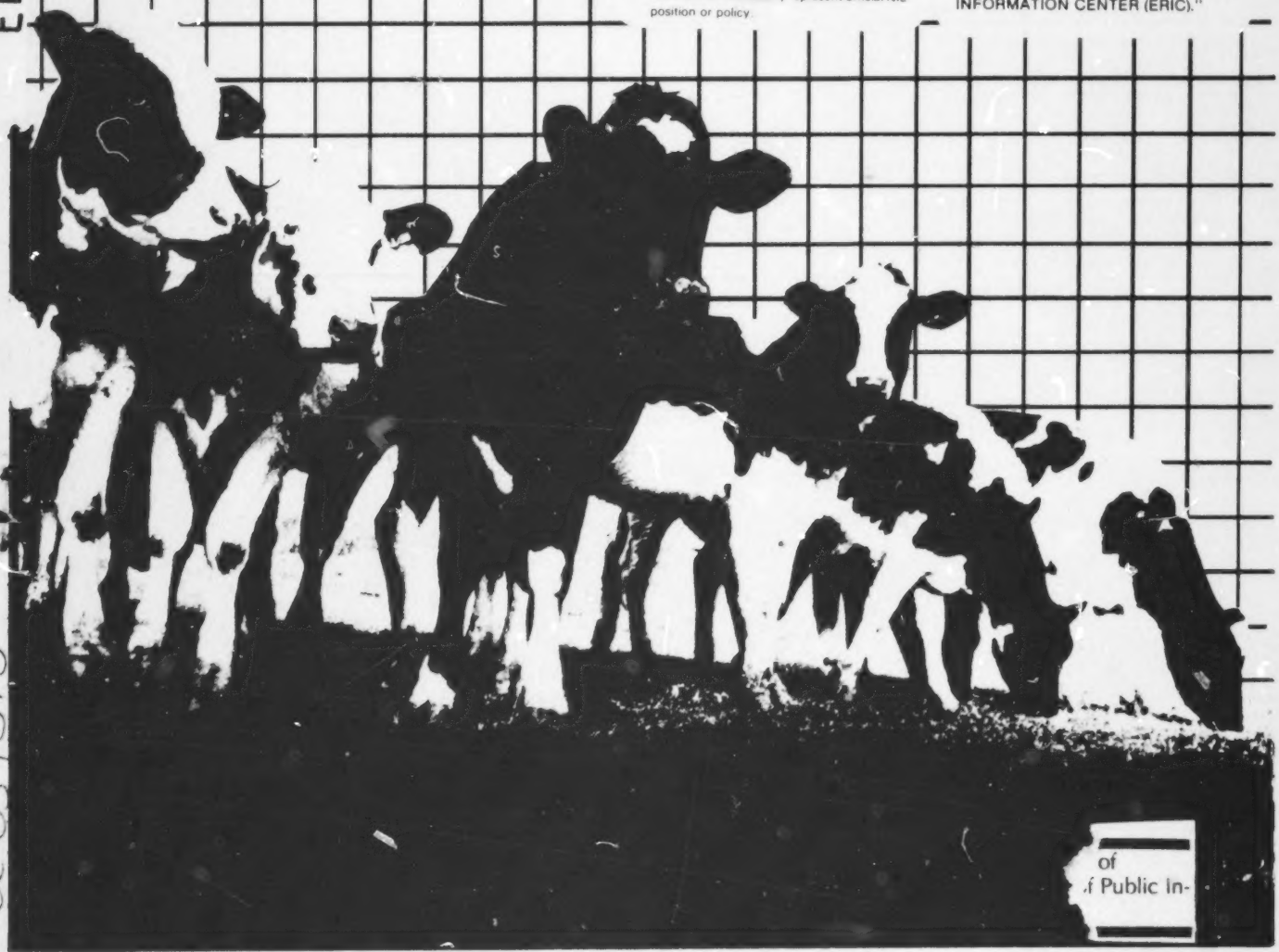

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Preface

This publication is designed to assist post-secondary and secondary teachers of agriculture in their use of the University of Wisconsin bulletin *Raising Dairy Replacements* in their dairy science instructional program. Each instructor is encouraged to make an individual decision as to the portion of the guide they will use.

Professor Neal Jorgensen of the UW-Madison Dairy Science Department provided the overall leadership for the new UW-Extension bulletin on which this guide is based. Professor James Crowley is gratefully recognized for his role in developing the basic dairy bulletin. A special thanks to Professors Jorgensen and Crowley and their colleagues for all their help in making this guide possible.

Many vocational agriculture/agribusiness instructors at the secondary and post-secondary level helped by reviewing the manuscript at various stages of development. Appreciation is extended them and to the following persons who have contributed to the development of this document:

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Introduction

What kind of cows will you milk three, four, or five years from now? Their size, milking ability, temperament, reproductive performance, disease resistance and type are influenced by current breeding decisions, care of pregnant cows and management of calves, from birth to freshening. Dairymen should raise rather than purchase replacements. It is less expensive to raise your own replacement heifers, especially when farm-grown forages and grain are available. In addition, you know the genetic ability and health history of home raised replacement heifers. Properly fed, housed and managed calves and heifers can improve your future success in dairying.

Lessons found in this unit are based upon research trials and the experience of successful dairymen. They are as follows:

1. Breeding Decisions
2. Management of Cows From Breeding to Calving
3. Care At Calving Time
4. The Newborn Calf-Birth to Weaning
5. Feeding Calf Starters
6. Calf Management Jobs
7. Keep Calves Healthy
8. Replacement Housing

Directions

Each lesson listed is followed by: 1) a performance objective, 2) teaching-learning activities (including technical content), 3) supplementary material (including transparency masters, slides and lists of references), and 4) check-out activities. Since the knowledge that dairymen can obtain in each of these lessons is necessary for successful herd replacement management, teach all the lessons unless local circumstances or previous learnings would cause this to be unnecessary.

1. Breeding Decisions

1.1 Performance Objectives

Given a written check-out activity concerning breeding decisions, the student will complete the check-out at a level of accuracy determined by the instructor.

1.2 Teaching-Learning Activities

a. Use resource persons such as university extension specialists, veterinarians or outstanding dairymen.
b. Visit an artificial insemination organization.

1.2.1 What kind of cows will you milk three, four, or five years from now?

a. Current breeding decisions, the care of pregnant cows and the management of calves from birth to freshening influence cows' size, milking ability, temperament, reproductive performances, disease resistance and type.
b. Dairymen should raise rather than purchase replacment.
   (1) It's less expensive to raise your own replacement heifers, especially when farm-grown forages and grain are available.
   (2) You know the genetic ability and health history of home-raised replacement heifers.

1.2.2 Heredity plus environment equals results.

a. Quality herd replacements begin with the genetic ability of the calves.
b. The best feeding and management program will not increase production beyond the inherited (genetic) potential of a calf.

1.2.3 Proven sires are the best bet.

a. Choosing the right bull is the first step in a successful replacement program.
b. Every dairyman has the opportunity to purchase semen from sires whose transmitting abilities have been carefully estimated.
c. Sire evaluations identify the transmitting ability of bulls.
d. The predicted difference (P.D.) of bulls increases the "odds" of accurately predicting the genetic ability of offspring.
e. Using semen from a bull with a P.D. of +2,000 pounds will not guarantee that all heifers will be better than cows now in your herd but, on the average, 8 of 10 heifers from that sire will be better. Similiarly 8 of 10 heifers sired by a bull with a P.D. of −2,000 pounds will have less milk-producing ability than their mothers.

1.2.4 Sons of high predicted difference bulls are the next best bet.

a. Bull studs continually add young sires to maintain a future supply of proven sires.
b. Although the transmitting ability of these young sires has not been completely evaluated, they are the carefully selected sons of bulls with high predicted differences and from carefully selected cows.
c. The chance of getting a good heifer from a young sire or from any unproved bull increases if he is the son of a plus-proven bull.

d. Sons of bulls with high P.D.s are likely to become plus P.D. sires, especially when the dams also have plus cow indexes (transmitting ability).
e. New bulls are continually evaluated to ensure continued genetic improvement.
f. Semen from young sires is less expensive.
g. Dairymen can safely breed 25 percent of the herd to young, unproved bulls, but you should breed the rest of the herd to plus-proven sires.
   (1) Select cows randomly from the herd to breed to young sires.
   (2) Be sure that young sires are the sons of bulls with high P.D.s and cows with plus indexes.

1.2.5 Using natural breeding may mean less genetic progress in a herd.

a. The cost of purchasing and maintaining a bull for natural service is usually greater than the cost of semen from carefully selected young sires available from artificial insemination (A.I.) organizations.
b. A dairyman who relies on only one unproved young sire takes more risks with the genetic ability of offspring than if he uses several unproved young sires.
c. Dairymen who rely on natural service usually make less genetic progress than those who use several top A.I sires.

1.2.6 Genetic gain is essential

a. Genetic progress requires careful selection of parents.
b. Select as parents of the next generation the best cows from each generation of calves.
c. Poor reproductive performance of cows or high calf losses obviously limit the number available for selection or culling.
d. If most of the replacements are needed to maintain herd size, a dairyman has limited opportunity to select and less chance to improve the genetic ability of a herd. Simply raising more calves does not improve the genetic ability of the herd unless you keep the best and cull the rest.
e. To accurately select cows for genetic herd improvement, use actual performance records of individual cows. Your feeding and management program must provide cows with an opportunity to show their genetic potential.
f. Dairymen with low-producing herds (those producing less than the breed average) may not be able to select replacements with the genetic potential for profitable production. If the genetic ability of the herd is very poor, buying replacements (or possibly embryos for transfer) may be the best way to adequately increase milk production.

1.2.7 Good breeding and selection programs are essentials for genetic progress.

a. A good breeding program
   (1) Use young sires with a high index (transmitting ability) on 20-30 percent of the cows and heifers in the herd.
   (2) If you use natural service, select a son of a high P.D. sire.
b. A good selection program
   (1) Keep complete records on each cow. This means you should keep track of feeding, reproduction, health, production and sire service. Researchers recommend you use record forms available through dairy herd improvement associations.
   (2) Keep complete records on each calf, including the identity of sire and dam.
   (3) Raise all heifers possible, including daughters of heifers bred to good dairy bulls.
      i. Use the best of these heifers for replacements.
      ii. Use additional well-bred heifers to replace cows culled for low production.
      iii. You can usually sell at a profit surplus heifers that meet requirements for replacements.

1.2.8 The annual culling and replacement rates determine the number of replacement heifers needed.

a. The annual culling or replacement rate in a milking herd is about 30 percent. This means that in a 50-cow herd you need each year 15 good 2-year-olds.
b. In an average 50-cow herd, you will need at least 20 heifer calves annually to provide 15 fresh 2-year-olds (See Tables 1 and 2).
   (1) From birth to freshening dairymen lose about 25 percent of the heifer calves born.
   (2) Fifteen to 20 percent die by 6 weeks of age.
   (3) Five percent are lost due to accidents or birth abnormalities.
   (4) Five percent are non-breeders.
c. Dairymen who breed only older cows to good bulls must use nearly all of the heifers to maintain herd size (Table 3).
   (1) If you need all or most of your heifers to maintain herd size, some heifers you are adding to the herd will have similar or less genetic ability than cows already in the herd.
   (2) To increase the genetic ability of your herd, breed all cows and heifers to good dairy bulls and raise all of the heifer calves possible.

(3) Breeding heifers to good bulls increases genetic progress in your herd. And the sale of surplus dairy replacments can increase your income.
   i. In a 50-cow herd, breeding 2-year-olds to good bulls lets dairymen cull five additional poor cows or undesirable heifers.
   ii. You can sell good heifers not needed in the herd for two or three times more than dairy calves from beef bulls.
   iii. When dairymen breed cows and heifers to good A.I. sires, increased milk production is possible (Table 4).

1.2.9 Poor breeding practices are costly.

a. Dairymen cannot afford to "sacrifice" a generation of calves from 2-year-olds, but that is the result if you breed heifers to beef bulls or poor dairy bulls.
b. The genetic potential of a heifer's first calf is the same as that of her later calves.
c. Some dairymen use beef sires, "jumper" bulls or other non-proved bulls for the convenience of getting heifers bred and to reduce calving problems.
   (1) Rely on good rations that add growth to heifers and breed heifers at the right size and age instead of using beef bulls to sire smaller calves.
   (2) To reduce calving difficulties, select A.I. bulls with good calving-ease ratings.
d. Hormones which induce heat and enable breeding at desired times are now available. Their use makes artificial insemination of heifers more convenient. Consult a veterinarian about this practice.
e. If you must use a pasture breeding or natural service, use a son of a high-plus P.D. dairy sire and a high-index cow.

1.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Degree of artificial insemination and effect on milk production.
   (2) Surplus heifers in a 100-cow herd.
   (3) Diagram showing relationships of various information to an animal's breeding value.
b. Slides
c. References

   (1) Bath, Donald L., Frank N. Dickinson, H. Allen Tucker, Robert D. Appleman. *Dairy Cattle: Principles, Practices, Problems, Profits.* 2nd Ed. Philadelphia: Lea and Febiger, 1978. Chapters 3-7.
   (2) Hoard, W.D. "Dairy Cattle Fertility and Sterility." *Hoard's Dairyman*, Fort Atkinson, WI: W.D. Hoard and Son, Co., 1979.
   (3) Schmidt, G.H. *Principles of Dairy Science.* San Francisco: W.H. Freeman and Company, 1974.
   (4) Sendelbach, A.G. *Predicted Difference and Repeatability.* University of Wisconsin-Extension, May 1977. A2146.
   (5) National Extension Workshop Publication. "National Workshop on Genetic Improvement of Dairy Cattle." St. Louis, April 6-7, 1982.

1.4 Check-Out Activities

a. Provide students with the following exercises.

T F 1. It is more expensive to raise your own replacment heifers than to buy them.

T F 2. The best feeding and management programs will increase production beyond the inherited (genetic) potential of a calf.

T F 3. The predicted difference of bulls increases the "odds" of accurately predicting the genetic ability of offspring.

T F 4. Dairymen who rely on natural service will make greater genetic progress than those who use several top A.I. sires.

T F 5. You will limit genetic progress in your herd if you need to use all replacements to maintain herd size.

T F 6. The genetic potential of a heifer's first calf is the same as that of her later calves.

T F 7. Use beef sires to reduce calving problems of heifers.

8. Heredity + _____ = results.

9. _____ is the best estimate of the amount of milk and butterfat that daughters of a bull are expected to produce compared to other cows milking in the same herd.

10. Dairymen can safely breed _____ of the herd to young, unproved bulls, but you should breed the rest of the herd to plus-proven sires.

11. The annual culling or replacement rate in a milking herd is about _____.

12. What is the first step in a successful replacement program?

13. What are the two essentials for genetic progress?

Answers

1. False
2. False
3. True
4. False
5. True
6. True
7. False
8. Environment
9. Predicted difference
10. 25 percent
11. 30 percent
12. Choosing the right bull
13. A good breeding program and a good selection program

b. Discussion
   (1) What are the advantages and disadvantages of using natural selection?
   (2) Discuss the role of hormones in a breeding program?
   (3) Why should dairymen raise rather than purchase replacements?
   (4) When would a dairyman use young, unproved bulls in a breeding program?

2. Management of Cows From Breeding to Calving

2.1 Performance Objectives

Given a written check-out activity concerning management of cows from breeding to calving the student will complete the check-out at a level of accuracy determined by the instructor.

2.2 Teaching-Learning Activities

a. Use resource persons such as university extension specialists, veterinarians or outstanding dairymen.
b. Visit an area farm to observe dry cow management programs.
c. Formulate a balanced dry cow ration that meets National Research Council (N.R.C.) requirements and utilizes feeds available in the area.

2.2.1 The genetic ability of a calf is determined at conception.

Proper management of a cow during her pregnancy, especially during the two months before she freshens, also affects the future productivity of a replacement.

2.2.2 While the cow is pregnant you should:

a. Keep accurate records of breeding dates, service sires, health, and production.
b. Follow a herd health program of pregnancy diagnosis and disease prevention.
c. Feed a balanced ration which is adequate for milk production and which will restore any weight the cow has lost in early lactation.
d. Provide a 6-8 week dry period.

2.2.3 Cows use energy more efficiently during the last 2 or 3 months of lactation to restore body weight than during the dry period.

2.2.4 Feed adequate nutrients in late lactation to set the cow in good condition. Then maintain condition of the cow and provide for growth of the calf.

a. Cows need a dry period of about 6 weeks for good milk production in the next lactation (Table 5).
b. Extending the dry period to more than 8 weeks only slightly increases milk production.
c. Long dry periods and excess energy intake increase metabolic problems (Table 6).
d. Incidence of displaced abomasum increases when dry cows received more than 25 percent of the total dry matter from grain (Table 7).

2.2.5 Dry cow rations should provide the nutrients recommended by the N.R.C. (Table 8).

a. Too little or too much energy, protein, or vitamins may increase the incidence of milk fever, ketosis, calving problems, fat cow syndrome and endanger the health of the calf.
b. Table 9 shows four examples of rations which meet N.R.C. requirements and utilize feeds which are usually available on Wisconsin dairy farms.
   (1) Dry cows as well as milking cows require bulky feeds in the ration to maintain rumen mobility.
   (2) A ration containing only finely chopped silage or high-moisture silage may lack adequate bulk.
   (3) Dry hay, corn stover or straw can provide bulk.

2.2.6 Balance dry cow rations as carefully as rations for lactating cows.

a. Do not feed dry cows the same rations you feed to milking cows.
b. In free stall barns or other free-choice feeding systems, separate dry cows from the milking herd.
c. Utilize laboratory tests of forages, grains and other available feeds and ration balancing programs to formulate economical rations for dry cows.

2.2.7 The care and feeding of dry cows affect calves.

a. Genetic factors, nutrition, age and the size and condition of the cow or heifer determine the size of the fetus and calving ease.
b. To reduce calving problems, breed heifers at the proper weight and age, to sires with good calving-ease ratings.
c. To reduce calving problems, have dry cows in good trim—not too thin and not too fat.

2.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Nutrient requirements of dry cows
   (2) Effect of dry period on milk production in next lactation.
   (3) Example dry cow rations.
   (4) Holstein and Brown Swiss growth chart.
   (5) Michigan dairy breeding and health record system.
b. Slides
c. References
   (1) Bath, Donald L., Frank N. Dickinson, H. Allen Tucker, Robert D. Appleman. *Dairy Cattle: Principles, Practices, Problems, Profits.* 2nd ed. Philadelphia: Lea and Febiger, 1978.
   (2) Hoard, W.D. *Hoard's Dairyman Feed Guide.* Fort Atkinson, WI: W.D. Hoard and Son, Co., 1978.
   (3) National Research Council (National Academy of Sciences). *Nutrient Requirements of Dairy Cattle.* 5th rev. ed. Washington, D.C., 1978.
   (4) Heifer Bulletin.

2.4 Check-Out Activities

a. Provide students with the following exercises.

T F 1. Proper management of a cow during her pregnancy has little or no effect on the size of the fetus and calving ease.

T F 2. To reduce the time used in ration formulation, feed dry and milking cows the same rations.

T F 3. Cows use energy more efficiently to restore body weight during the last 2 or 3 months of lactation than during the dry period.

T F 4. Dry hay is an example of a bulky feed that you can use in a dry cow ration.

5. Cows need a dry period of about _____ for good milk production in the next lactation.

6. Name a problem that might arise from feeding a poorly-balanced ration to a dry cow.

_____

3.2.1 Care at Calving time is important.

a. Approximately 5 percent of calves are born dead (still births).
b. You can save many of these calves if you are present at birth to render proper assistance.

7. The purpose of providing bulky feeds in the dry cow ration is to _____.

8. The dry period is used to maintain condition of the cow and to _____.

Answers:

1. False
2. False
3. True
4. True
5. 6-8 weeks
6. Milk fever, ketosis, retained placenta, mastitis, fat cow syndrome and calving problems.
7. Maintain rumen mobility
8. Provide for growth of the calf.

b. Discussion Questions
   (1) What are the possible effects of a dry period that is either too short or too long?
   (2) What is meant by the term fat cow syndrome? What effect does it have on calving?
   (3) Why is it important to breed heifers at the proper weight and age and to sires with good calving ease ratings?
   (4) Discuss the necessary steps in formulating a dry cow ration that meets N.R.C. requirements and utilizes locally available feedstuffs.

3. Care At Calving Time

3.1 Performance Objectives

Given a written check-out activity concerning care at calving time, the student will complete the check-out at a level of accuracy determined by the instructor.

3.2 Teaching-Learning Activities

a. Use resource persons such as university extension specialists, veterinarians or outstanding dairymen.
b. Visit an area farm to observe a cow freshening.

c. Too often herdsmen may give cows assistance only after the cow or calf is in critical condition.
d. Attend the cow while she is in labor and during birth.
e. The increased value of cows and calves makes it very profitable to be present during the birth process to ensure that the cow and unborn calf receive assistance if they require it.

3.2.2 Use maternity stalls.

a. Isolate the cow a week or 10 days before she is expected to calve.
b. The cow and the newborn calf need protection from other cows.
c. Put the cow in a clean, dry, nearly square box stall which provides about 150-200 square feet of space. The box stall should be well lighted and airy but be free from drafts.
   (1) Apply lime or other granular material to the floor before covering it with adequate amounts of a dry, comfortable bedding such as fresh clean straw, ground corn cobs or shredded corn stalks.
   (2) A good non-slip base and adequate amounts of dry, comfortable bedding can prevent many stifle injuries, ruptured adductor muscles and udder trauma during calving.
   (3) Do not use wet sawdust, old moldy hay, moldy damp silage or spoiled haylage for bedding because these materials contain organisms that can infect the uterus and udder of the cow in addition to harming the calf.
d. A well-drained paddock or small pasture with shade is a good calving area during mild, dry weather.

3.2.3 Be present at birth.

a. Most cows calve without assistance, however, dairymen never know beforehand which cows may need help.
b. Heifers and younger cows are more likely to require assistance than older cows.
c. Assistance is more likely to be required for bull calves and multiple births.
d. Calf mortality rates increase dramatically with the difficulty of birth (Table 10).
   (1) North Carolina University researchers estimate that each difficult birth costs $40-$75 due to increased deaths of calves and cows, reduced milk production, rebreeding problems and the cost of additional labor required in delivery.
   (2) Proper management of dry cows and heifers and using sires with good calving ease ratings can reduce economic losses associated with difficult births.

3.2.4 How do you recognize the stages of birth?

a. Check cows every two hours after labor begins. You can determine how the birth process is progressing by watching for certain signs.
b. Stage I—restlessness
   (1) A cow will often roll feed around in her mouth but will not swallow it.
   (2) The cow gets up and lies down frequently and doesn't seem to be comfortable.
   (3) Visible labor begins when the water bag breaks. The slippery and viscous material found in the water bag is absolutely essential for a normal, trouble-free birth.
      i. For mature cows, the calf should be in the pelvic inlet within 2 hours after the water bag breaks.
      ii. For heifers as long as 4 hours may elapse after the water bag breaks before the calf enters the pelvic inlet. It takes longer for the muscles in the pelvic inlet of heifers to relax.
c. Stage II—the fetus is delivered.
   (1) For cows, the fetus should be delivered 1/2 to 1 hour after it appears in the pelvic inlet.
   (2) For heifers, the fetus should be delivered within 2 hours after it appears in the pelvic inlet.
d. Stage III—the placenta (afterbirth) is passed in 1/2 to 8 hours after the fetus is delivered.
e. Stage IV—the uterus returns to normal 15-30 days after birth.
f. Some cows show noticeable signs of calving and will give birth in a few hours while others may not calve until the next day or may calve earlier than expected.
   (1) Calving has definitely started when the water bag breaks.
   (2) Continue monitoring the progress of the cow during calving and if the cow does not progress according to the schedule above, call a veterinarian to examine her.
g. A calf is normally born head first with its head placed on both front legs.
   (1) Breech or backward deliveries are fairly common and cause no problem if both rear legs and the tail are presented. However, if there is any delay in final calving after the umbilical cord breaks, the calf will suffocate.
   (2) Get professional help if a calf is delivered in any other position than head first or breech.

3.2.5 When is help needed?

a. The earlier you determine that an abnormal condition is delaying the birth process, the easier it is to correct the problem and to ensure the well-being of the dam and calf.

b. If the position of the calf is normal, experienced herdsmen provide the assistance the cow needs during birth.
c. An inexperienced dairyman should work closely with a veterinarian or an experienced herdsman to obtain experience and confidence.
d. Here are some birth guidelines:
(1) Always wash the cow and your hands with detergent before examining her. Use disposable plastic sleeves.
(2) Have on hand a set of obstetrical chains, or two 6-foot lengths of 3/8 inch nylon rope and soap and water.
i. Sterilize the chains or nylon ropes by boiling them for 15 minutes or by placing them in a small paper sack and heating them in an oven for 30 minutes at a temperature of 300°F. Seal the sack with masking tape when you remove the bag from the oven. This will keep the contents relatively sterile for about 30 days.
ii. Never leave these tools in the barn since dust and manure could be the source of infectious organisms if introduced into the uterus.
(3) If a cow requires assistance during a normal delivery tie either the obstetric chains or the nylon rope above pastern of the calf—not below the pastern.
(4) Once the head and feet (or the hind feet and tail) are outside the uterus, pull parallel with cow's hind legs.
i. Pull directly down if the cow is standing.
ii. Pull parallel to her hind legs if she is lying down.
(5) Be gentle. Do not use excessive force.
(6) Work with the cow as her abdominal muscles contract.
i. When she relaxes, merely keep the "ground" you have gained and pull again as her abdominal muscles contract again.
ii. Working with the animal makes delivery much easier.
(7) You should never attempt to pull a calf unless either the calf's two front feet and its head or its two back feet and the tail are in the pelvic inlet.

3.2.6 Retained placentas can cause problems.

a. The cow should expel the afterbirth within 8 hours after birth.
b. Cows which have had a difficult time calving, those giving birth to twins, those with infections and overconditioned cows are more likely to retain their placentas.
c. In a well-managed herd, 5 to 10 percent of the cows will usually need to be treated by a veterinarian for problems related to retained placentas.
d. If more than 8 percent of the cows have problems with retained placentas, poor feeding, management, or sanitation may be the cause.
e. You can feed or inject supplemental selenium and vitamin E three weeks before calving to reduce the incidence of retained placentas if rations are selenium-deficient. However, selenium will not correct problems caused by other improper feeding or management practices.
f. If a cow retains her placenta for more than 12 hours, has an excessive discharge from her vagina, has a high body temperature or goes off feed, get advice and assistance from a veterinarian.

3.2.7 There are certain actions to look for immediately after calving.

a. The cow should get up and assist the calf within 1/2 hour after giving birth. If she does not get up soon after birth, get advice and assistance from a veterinarian.
b. The herdsman should provide good, slip-free footing in the pen and adequate amounts of bedding so the calf and cow are dry.
c. The cow should pass manure and drink water shortly after giving birth. Feeding warm water and bran mash to a cow after calving is a good "old time" treatment used by many herdsmen.
d. A normal cow will be alert, have a normal body temperature and be willing to eat and drink within an hour or two after calving.
e. Let the cow lick the calf after delivery. Licking stimulates the calf's blood circulation and may increase absorbtion of immunoglobias in colostrum.

3.3 Supplementary Materials

a. Transparency masters—**See Appendix**
(1) Calf mortality by difficulty of birth category.
(2) Abnormal birth positions.
b. Slides
c. References
(1) Bath, Donald L., Frank N. Dickinson, H. Allen Tucker, Robert D. Appleman. *Dairy Cattle: Principles, Practices, Problems, Profits.* 2nd ed. Philadelphia: Lea and Febiger, 1978.
(2) Bringe, A., H. Larsen, G. Tenpas, R. Vilstrup, G. Krueger, J. Andersen. *Calf Management-Birth to Weaning.* University of Wisconsin-Extension, March 1978. A2841.

(3) Hoard, W.D. *Hoard's Dairyman Herd Health Guide*. Fort Atkinson, WI: W.D. Hoard and Son, Co., 1981.
(4) Wilcox, C.J., H.H. Van Horn, B. Harris Jr., H.H. Head, S.P. Marshall, W.W. Thatcher, D.W. Webb, J.M. Wing. *Large Dairy Herd Management*. Gainesville: University Presses of Florida, 1978.

3.4 Check-Out Activities

a. Provide students with the following exercise.

T F 1. Give assistance to cows only after the cow or calf is in critical condition.
T F 2. Heifers and younger cows are likely to need assistance when calving.
T F 3. Using sires with good calving ease ratings can help reduce the possibility of difficult births.
T F 4. The viscous material found in the water bag is dangerous to the health of both the cow and calf.
T F 5. A calf is normally born head first with its head placed on both front legs.
T F 6. Breech deliveries are extremely rare and cause serious problems if not immediately attended to.
T F 7. The uterus of the cow returns to normal immediately after birth.
T F 8. Store obstetrical chains in the barns so they are close at hand if needed.
T F 9. Isolating the pregnant cow from the rest of the herd is only necessary if the herdsman expects problems.
T F 10. The cow should get up and assist the calf within 1/2 hour after giving birth.
11. Calf mortality rates _____ _____ dramatically with the difficulty of birth.
12. Visible labor begin when the _____ breaks.
13. Check cows every _____ after labor begins.
14. Approximately _____ percent of the calves are born dead.
15. Feeding or injecting supplemental _____ three weeks before calving helps to reduce the incidence of retained placenta if the ration is deficient in that element.

Answers

1. False
2. True
3. True
4. False
5. True
6. False
7. False
8. False
9. False
10. True
11. Increase
12. Water bag
13. Two hours
14. 5
15. Selenium

b. Discussion Questions
(1) Why should a cow be allowed to lick the calf after delivery?
(2) Why it is important to isolate the pregnant cow from other cows a week or 10 days before she is due to calve?
(3) Why should you avoid using wet sawdust or spoiled haylage as bedding material in a maternity stall?
(4) Briefly explain the four stages of birth.
(5) Describe a method that you can use to sterilize obstetrical chains or nylon ropes.
(6) Why is it important to provide a good non-slip base in the maternity stall?
(7) Briefly outline the steps a herdsman would take to provide assistance to a cow during a normal delivery.

4. The Newborn Calf—Birth to Weaning

4.1 Performance Objectives

Given a written check-out activity concerning the newborn calf—birth to weaning the student will complete the check-out at a level of accuracy determined by the instructor.

4.2 Teaching-Learning Activities

a. Use resource persons such as university Extension specialists, veterinarians or outstanding dairymen.
b. Develop a feeding program for the newborn calf—birth to weaning which is appropriate for your area.

4.2.1 The newborn calf has many needs.

a. The calf must start breathing as soon as the umbilical cord breaks.
(1) Remove mucus from the calf's nostrils and rub the calf vigorously with a clean towel.
(2) If the calf fails to start breathing, stimulate the breathing mechanism by inserting the handle of a small clean spoon up its nostrils about 2 inches. Use your finger if no spoon is available.

i. Rotate vigorously. This stimulates a nerve in the nostril that initiates breathing.
ii. Do not pound the calf on the chest or shake it by its hind legs. This usually does more harm than good.

b. Immediately tie off the navel cord about 2 inches from the body line to prevent bacteria from entering the broken umbilical cord.
(1) Use common household string which you keep in a clean glass jar filled with a solution of 70 percent rubbing alcohol.
(2) Or use special plastic clips available from veterinary suppliers.
i. Use only the large clips and place them two inches from the body line.
ii. Tying the navel or placing a clip too close to the body may cause a hernia.

c. After tying the navel, remove the excess cord and any foreign material.

d. Thoroughly disinfect the umbilical stump with a 7 percent tincture of iodine solution.
(1) Be sure the disinfectant gets into every crack and under any hair or other material.
(2) It is better to "soak" the umbilical stump in the iodine solution than to quickly "dip" it in the solution.
(3) Common household aqueous 1-2 percent iodine solutions are not effective disinfectants.

e. If possible, let the cow lick the calf dry.
(1) Otherwise, dry the calf with clean cloths or paper towels.
(2) Make sure the bedding is dry and do not expose the calf to drafts.

4.2.2 Feed the newborn calf promptly.

a. Promptly feeding colostrum to newborn calves is one of the most important steps to increase calf survival rates and health.
(1) Colostrum is the best source of nutrients for the newborn calf.
(2) It is irreplaceable in providing calves with the antibodies for resistance to disease and infections.

b. Milk out and feed colostrum within 30 minutes after birth.
(1) Feed an amount equal to 4-5 percent of the birth weight of the calf.
(2) Weigh or measure the colostrum. One quart weighs about 2 pounds.

4.2.3 Feed newborn calves colostrum and transitional milk.

a. The first feeding of colostrum plus the next two feedings during the first 24 hours are extremely important. During this time feed the calf an amount of colostrum equal to 12-15 percent of its birth weight.

b. Although colostrum is commonly thought of as the secretions from the first 10 milkings, true colostrum is obtained only from the first milking. The milkings during the next 4 or 5 days are transitional milk.

c. True colostrum contains more total solids and immunoglobulins—antibodies that help newborn calves fight infections—than does transitional milk.
(1) Bovine colostrum consists of a mixture of milk secretions and constituents of blood serum, notably immunoglobulins and other serum proteins. Colostrum accumulates in the mammary gland during the dry period.
(2) The composition of transitional milk is similar to that of whole milk by the sixth milking although milk is not legally saleable until after the fifth day (usually the 11th milking).

d. If the cow is milked before calving, leaks milk before she calves, or the colostrum appears abnormal, feed the newborn good-quality colostrum saved from another cow.

e. Freeze a supply of good-quality true colostrum to feed when a mother's colostrum is poor.

f. All unsaleable milk (colostrum and transitional milk) should be used to raise dairy calves.

4.2.4 Immunoglobulins are antibodies to fight infections.

a. Length of the dry period may influence the concentration of immunoglobulins in colostrum.
(1) The dry period should be at least 40 days in length.
(2) An adequate dry period appears necessary for immunoglobulins to accumulate in colostrum.

b. Whole milk contains about 0.1 percent immunoglobulins. The immunoglobulin content of colostrum varies from 2 to 23 percent and is directly related to the percentage of solids in true colostrum, which varies from 13 to 36 percent. In other words, colostrum containing more solids also usually contains a higher percentage of immunoglobulins.

c. The appearance of colostrum is an indication of its quality.
(1) Good colostrum containing a high percentage of solids, and then a high percentage of immunoglobulins will be thick and creamy.
(2) Thin and watery colostrum should not be fed to newborn calves since it is low in solids and immunoglobulins.
(3) Do not feed excessively bloody or mastitic colostrum.

(4.)Use good quality frozen colostrum if the mother's colostrum appears to be abnormal.

(5) Table 11 shows colostrum containing about 24 percent solids and 6 percent immunoglobulins.

d. Colostrum and transitional milk contain several types of immunoglobulins (Table 12).

e. The immunoglobulin content of the second milking is largely determined by how completely the cow was milked the first time.

(1) On the average, the second milking contains 60-70 percent as much immunoglobulins as the first milking (Table 11).

(2) Immunoblobulins in both the first and second milkings help a calf develop passive immunity (Table 13).

4.2.5 A newborn calf acquires passive immunity.

a. A calf is born essentially without any immunities (resistance) to infections and diseases.

b. A newborn calf acquires passive immunity when it absorbs intact (whole) immunoglobins through the intestinal wall during the first 24 hours of life. Absorption of the available immunoglobulins averages 20 percent, although it can vary from 6 to 45 percent.

(1) Each form of immunoglobulin gives a calf some immunity against a specific disease or infection.

(2) The dam "manufactures" these immunoglobulins when she encounters disease organisms or is vaccinated.

i. A calf raised on the same farm as its dam is usually better protected against diseases on that farm than a purchased calf or a calf from a cow purchased shortly before calving.

ii. Additional exposure of older cows to disease organisms and infections also means that the percentage of immunoglobulins in colostrum from mature cows may be more than twice that in colostrum from first-calf heifers.

c. Immunoglobulin concentration is highest at calving and begins decreasing soon after birth (Fig. 2). A long delay between calving and first milking reduces the amount of immunoglobulins as colostrum is diluted with newly synthesized milk.

d. Passive immunity remains for about 2 months after; long enough for a calf to begin producing its own antibodies.

e. The degree of passive immunity is related to the concentration of immunoglobulins in a calf's blood serum. For these reasons:

(1) Harvest and feed colostrum within 30 minutes after birth.

(2) At this time feed an amount equal to 4-5 percent of a calf's birth weight.

(3) Table 13 shows that a 90-pound calf fed 4.5 pounds of colostrum at each of the first two milkings will absorb enough immunoglobulins to develop passive immunity.

f. Calves may not develop passive immunity when:

(1) They are not fed enough colostrum.

(2) They are fed colostrum containing low amounts of immunoglobulins.

(3) They are not fed colostrum within 30 minutes after birth.

(4) They lack the ability to efficiently absorb immunoglobulins.

g. A calf loses its ability to absorb immunoglobulins within 24 hours after birth (Fig. 2).

(1) Most immunoglobulin absorption occurs within the first 4 hours after birth and then steadily declines over the next 20 hours.

(2) Calves fed the proper amount of colostrum soon after birth quickly transfer immunoglobulins to the blood.

h. Occasionally a calf's intestines may become impermeable to immunoglobulins soon after birth (hypogammaglobulinemia).

i. Some calves may secrete large amounts of hydrochloric acid into their abomasums immediately after birth. This acid may break down immunoglobulins and reduce development of passive immunity.

4.2.6 Start the calf right.

a. Some research shows that mothered calves have higher levels of serum immunoglobulins than non-mothered calves when calves have been fed the same amount of colostrum. The increased absorption of immunoglobulins may be partially due to the stimulation of a calf's digestive system when a dam licks a calf.

(1) Some dairymen prefer to leave the newborn calf with the cow for a period of time ranging from a few minutes to several hours.

(2) Others remove the calf immediately after birth.

(3) Both methods have proven successful as long as a calf is fed the correct amount of colostrum at the first and second feedings.

b. Other research indicates that calf mortality tends to increase when calves remain with dams (Table 15).

(1) Dairymen who leave calves with dams generally assume calves will obtain adequate amounts of colostrum by nursing.
(2) Dairymen who separate calves soon after birth better control calves' colostrum intake.
(3) Table 14 shows that adequate intake of colostrum during the first 12 hours after birth decreases calf mortality rates.
(4) Nursing calves also risk contact with disease organisms if udders are not properly cleaned and may not receive needed nutrients and antibodies if colostrum quality of the cow has not been checked.

c. Even if a newborn calf is left with the dam, milk the cow, inspect the colostrum for normal appearance, weigh the recommended amount and feed it to the calf. Do this at each scheduled feeding.
(1) The calf may nurse between scheduled feedings but do not depend on the calf to nurse the recommended amount of colostrum within 30 minutes after birth or to obtain adequate amounts during the first 12 hours.
(2) A calf left with a cow for more than 12 hours may butt and damage the cow's udder.

d. If a calf is too weak to drink, force-feed colostrum with a stomach tube or esophogeal feeder. You can purchase these from a veterinarian or veterinary supply store.

4.2.7 Teach calves to drink.

a. Calves may be fed from a nipple bottle, nipple pail or an open bucket.
(1) Nipple feeding forces calves to drink more slowly and there is some evidence that it helps reduce gulping of milk and digestive disturbances.
(2) Make sure that the nipple and the pail or bottle are clean. Otherwise, nipple feeding may cause more problems than if calves drink milk rapidly from a clean, open pail.
(3) Raise the nipple or open bucket while feeding so the calf must keep its head up while it nurses or drinks.

b. Training a calf to drink from an open pail is easier if a newborn calf is immediately removed from the cow. Newborn calves that have never nursed learn to drink rapidly. A good procedure for teaching a calf to drink is to:
(1) Back the calf into a corner and straddle its back.
(2) Dip two fingers into the warm milk while it sucks your fingers.
(3) Remove your fingers when the calf starts drawing milk into its mouth.
(4) Warm milk and patience are needed to teach a calf to drink.

4.2.8 Avoid stress.

a. Avoid heat stress on newborn calves.
(1) Heat stress due to hot weather during the first 24 hours after birth reduces a calf's serum immunoglobulin levels and increases calf mortality rates.
(2) Provide shade for cows that calve outside during warm weather and make sure buildings are properly ventilated if cows calve indoors.

b. Increased calf mortality during cold weather may be caused by drafts, wet conditions or other poor management practices rather than any decline in immunoglobulin levels.

4.2.9 Freeze extra colostrum.

a. Cows may be milked out completely after they calve.
b. Remove at least some extra colostrum from older cows that have produced good quality colostrum and save this for calves from other cows that produce abnormal (mastitic, bloody or watery) colostrum.
c. Freeze this extra colostrum in containers which hold an amount needed for a single feeding (3-5 pounds).
d. Before you need the colostrum, remove it from the freezer and let it slowly thaw to room temperature.
e. Do not heat it to high temperatures since this destroys immunoglobulin value.

4.2.10 Feed newborn calves fresh colostrum and transitional milk.

a. Newborn calves can be fed colostrum and transitional milk continuously until they are weaned.
b. Extra colostrum may be stored economically at room temperature as fermented or sour colostrum.
c. Fermented or sour colostrum is an economical feed for raising calves. Use the following guidelines when storing and feeding fermented colostrum.
(1) Feed newborn calves fresh or frozen colostrum for the first two feedings. Then feed transitional milk for at least the next four feedings (48 hours) at a rate equivalent to 4-5 percent of a calf's birth weight at each feeding.
i. Do not feed sour colostrum for the first 48 hours after feeding.

i. Fermentation reduces the immunoglobulin content of colostrum and the acid in fermented colostrum may cause digestive upsets in newborn calves.

(2) Store any excess colostrum and transitional milk in a clean plastic garbage container or other plastic-lined container.

i. Keep containers covered to avoid contamination with dirt or other disease-causing, germ-laden material.

ii. Do not store fermented colostrum in old milk cans or other metal containers because the acid in fermented colostrum quickly corrodes metal.

(3) Slowly mix the contents every time any fresh colostrum or transitional milk is added.

i. Do not add extremely bloody or antibiotic-treated milk to the container.

ii. Antibiotics may prevent bacterial growth and prevent the proper fermentation.

(4) Start feeding the fermented colostrum at the fifth feeding (third day).

i. Always stir before removing fermented colostrum.

ii. Dilute 3 parts fermented colostrum with 1 part warm water. Average solids content of pooled colostrum is 15-17 percent. Adding 1 part warm water to 3 parts fermented colostrum results in a mixture containing about 12 percent solids.

(5) Store fermented colostrum at a relatively cool temperature (less than 70°F).

(6) Use a chemical additive to preserve fermented colostrum if natural fermentation is not likely, for example, if you store it at temperatures warmer than 70°F.

i. Chemical additives can be used instead of relying on natural fermentation. Use propionic acid, a propionic-acetic acid mixture or a commercial product. Add the acid at the rate of 1 percent to fresh product.

ii. Mix fresh milk and acid before pouring it slowly into the container.

iii. Use commercial products according to label directions.

(7) Feed fermented or acid-preserved colostrum within 3-4 weeks after it has been collected since nutrients, especially proteins, gradually break down during storage.

d. Feeding value of fermented colostrum is about equal to that of whole milk. Calves fed fermented colostrum gain about the same as those fed whole milk (Table 16).

4.2.11 Whole milk can be the primary feed until calves are weaned.

a. Whole milk can be the primary feed for calves until they are weaned.

b. Limited whole milk supplemented with proper amounts of starter is the best feed for growing young calves.

(1) Milk replacer is usually less expensive than saleable whole milk.

(2) Calves fed a good replacer make adequate growth but are not usually as sleek in appearance as those fed whole milk.

c. Whole milk improves the sleek appearance of calves raised for show or sale. However, there is no evidence that sleek appearance improves a calf's mature size or production ability.

d. With careful feeding and good management, large-breed calves weaned at five weeks can be raised on 270 pounds of saleable milk plus 45 pounds of unsaleable milk (colostrum plus transitional milk) fed during the first 5 days. Weaning at 8 weeks requires 45 pounds of unsaleable milk plus 460 pounds of saleable milk (Table 17).

e. Keep fresh starter available at all times.

f. Overfeeding whole milk can cause indigestion and scouring.

(1) Do not feed calves as much milk as they will drink. A sudden change in either the quantity or quality of milk can cause digestive problems.

(2) To avoid digestive upsets, either weigh or measure the milk fed each calf or use a container holding the correct volume of milk.

i. Substantial changes in the fat and solids content of milk can cause digestive upsets. (Table 18 shows the composition of milk by various breeds.)

ii. If milk containing more fat (5.5 percent) replaces a milk containing less fat (3.5 percent), add 1 part warm water to 3.5 parts of high-fat milk to help prevent indigestion and scours.

iii. Milk containing less fat will not cause digestive upsets when it is substituted for richer milk.

f. The amount of whole milk fed depends on the birth weight and vitality of the calf and the fat content of the milk.

(1) The rule of thumb to "feed 1 pound of milk per day for each 10 to 12 pounds of body weight at birth" is a fairly satisfactory feeding guide. You should feed calves this amount until they are weaned.

(2) Feed a calf milk equivalent to about 8 percent of its birth weight but no more than 10 percent of birth weight.

(3) Underfeeding whole milk may not provide calves with the nutrients they need for growth, especially during the first 3-4 weeks (see Figures 3 and 4).
(4) Calves fed too much milk will not consume adequate amounts of dry feed.

g. Consider the quality of whole milk.
(1) Milk should be fresh, sweet and clean.
(2) Temperature of milk should be uniform.
i. You may warm milk to about 100°F if you desire.
ii. Milk for older calves need not be quite so warm or so uniform in temperature.
(3) You may safely feed calves bloody milk caused by a cow's ruptured blood vessel.
i. Do not feed bloody milk from a cow that has an elevated temperature or that is off feed.
ii. Milk from such a cow may contain harmful bacteria.

h. Here are rules for feeding mastitic or antibiotic-treated milk.
(1) Mastitic milk or milk from cows treated for mastitis can be fed to calves housed and fed in individual stalls or if each calf is locked up separately for at least 30 minutes after feeding.
i. Calves fed mastitic milk that suck each other may innoculate the rudimentary teats and cause heifer mastitis.
ii. Calves consuming mastitic milk do not pass these organisms from the gut to the udder.
iii. Organisms enter the undeveloped mammary gland through the rudimentary teats when they are sucked by other calves.
(2) Milk from antibiotic-treated cows cannot be sold for the specified withholding time.
(3) Calves fed milk or milk replacer containing antibiotics cannot be sold for slaughter until all antibiotics have been eliminated.

i. You can substitute extra transitional milk for whole milk.
(1) The nutrient composition of transitional milk is essentially the same as whole milk by the sixth milking. During this time protein and immunoglobulin levels decrease and lactose levels increase (Table 11).
(2) Transitional milk stored with colostrum contains some immunoglobulins that may help control bacterial growth in the gut.
(3) When transitional milk is substituted for "normal" milk, dilute 3 parts transitional milk with 1 part water.
i. Dilution reduces the percentage of solids in transitional milk so it equals that of whole milk. Whole milk contains 12.5-13 percent solids while transitional milk averages about 15-16 percent solids.
ii. A 3:1 dilution rate for transitional milk helps avoid stomach upsets in calves already adjusted to "normal" milk.

4.2.12 You can feed calves skim milk.

a. Excellent calves can be raised by the "skim milk" method.
b. Feed whole milk until the calf is about 3 weeks old, then gradually shift to skim milk during the next week. Gradually increase the amount fed until about 15 pounds of skim milk are fed daily.
c. Feeding value of 1 pound of skim milk powder equals that in 10 pounds of skim milk.
(1) Mix 1 pound of powder with 9 pounds (about one gallon) of warm water.
(2) Feed about 15 pounds of the reconstituted liquid skim milk to large-breed calves.
(3) Powder may be economical to use when dry skim milk is relatively low in price.
(4) Be sure to keep a high-quality starter available at all times.
(5) Remember that skim milk powder does not contain vitamins A and D nor does it contain trace minerals normally added to milk replacer.
(6) Do not feed milk, milk replacers or whey powders that have been overheated because heat-damaged proteins have very low digestabilities.

4.2.13 You can feed calves liquid or dry whey.

a. Clean, fresh sweet whey may be fed to calves with fair success.
(1) Sweet whey must be fed fresh daily.
(2) Keep feeding equipment clean.
(3) Avoid overfeeding. Overfeeding may lead to excessive urination and loose feces.
b. Acid whey is not recommended for growing replacement heifers because it may cause sore gums and tooth decay.
c. You can gradually switch from whole milk to whey over a period of 7-10 days when the calf is more than four weeks old.
(1) Since whey is low in protein, you will need to use a high-protein starter.
(2) A starter must provide vitamins and trace minerals.
d. Good-quality dried whey is a satisfactory substitute for fresh whey. Mix 1 pound dry whey in 9 pounds water (10 percent solids).

4.2.14 You can feed combination growing rations to calves.

a. You can use whole milk-milk replacer, whole milk-skimmed milk or whole milk-whey combinations.
b. Combinations of fermented or sour colostrum and milk replacer are also satisfactory growing rations for calves.
c. Make gradual changes to avoid digestive upsets. It is best not to change the feeding program during the first 2 weeks.

4.2.15 You can feed calves milk replacer.

a. You may start calves on a milk replacer at 4-6 days of age. However, many dairymen feed calves whole milk until the animals are 10-14 days old, then the herdsmen switch the calves to a milk replacer.
b. Replacers usually contain less fat than dry whole milk.
   (1) Most replacers contain 75-85 percent as much energy as whole milk on a dry basis.
   (2) Calves fed milk replacers weigh slightly less than calves fed whole milk. This reduction, however, is not "unhealthy" since the primary goal is to wean a healthy calf with adequate skeletal growth (Figure 5).
c. Table 19 shows milk replacer plans for twice-a-day feeding.
   (1) In all these plans colostrum and transitional milk are fed at least until calves are 4 days old.
   (2) Milk is not legally saleable until the sixth day after freshening.
   (3) There is some benefit in feeding fermented, frozen or refrigerated colostrum or other whole milk until calves are 14 days old. Very young calves fed milk replacer are more likely to scour then calves fed whole milk.
d. Feed a good-quality milk replacer. A replacer's feed tag or label provides basic information on the product's nutrient content and ingredients. A replacer designed specifically for calves more than 3-4 weeks of age should not be fed to younger calves. Compare the tag information to the following general guidelines:
   (1) Fat
      i. The energy content of a milk replacer varies with the amount of fat. The fat content of replacers may range 3 to 24 percent.
      ii. University of Wisconsin researchers found that there was no real difference in the performance of calves raised in hutches fed milk replacers containing 10, 12 or 20 percent fat. Milk replacers containing the higher levels of fat may be of some benefit when calves are raised in less than ideal conditions.
      iii. High levels of fat are recommended for finishing veal calves.
      iv. The quality of fat is as important as the quantity of fat. Animal fats (lard, tallow or grease) are the best fat sources. You may use hydrogenated vegetable oils (solid at room temperature) but liquid (unsaturated) vegetable oils are not satisfactory.
   (2) Protein
      i. A milk replacer containing only milk proteins should contain at least 20 percent protein. Replacers should contain more than 20 percent protein if some lower quality proteins are substituted for high-quality milk proteins.
      ii. Protein quality can have a significant effect on calf growth. Table 21 compares the performance of calves fed replacers containing all milk protein with calves fed milk replacers containing other sources of protein.
      iii. Proteins may be damaged by excessive heat during processing. Performance of calves is the true indication of the value of milk replacers.
   (3) Carbohydrates
      i. Lactose (milk sugar) is the best source of carbohydrates for calves.
      ii. Other carbohydrates (starch and sugar) are poorly digested by young calves. Excessive starch intake is the primary cause of scours in calves less than 21 days of age. Milk replacers containing starch should only be fed to calves that are at least more than 2 weeks old and preferably to calves more than 3 weeks old.
      iii. Newborn calves do not utilize fiber; however, fiber does not harm the calf. More than 0.25 percent fiber in a replacer usually indicates that the milk replacer contains a plant source of starch or protein.
   (4) Minerals and vitamins
      i. Since milk replacers are fortified with minerals and vitamins, additional supplements of minerals and vitamins are not usually needed.
      ii. However, many dairymen provide calves with free access to trace mineral salt.

iii. Injecting vitamins A, D and E assures adequate levels for purchased calves that may have received limited amounts of colostrum before being sold. Vitamin injections also provide reserves that a calf stores and uses if feed is withheld during scours treatment or when the animal is off-fed for any reason.

(5) Antibiotics

i. Many milk replacers contain antibiotics. When dairymen feed replacers according to manufacturer's directions, legal level of antibiotics are not exceeded.

ii. Antibiotics are no substitute for good management. Their value in reducing the incidence of scours and respiratory problems is debated.

iii. Be sure to follow recommended withdrawal times to avoid illegal residues if calves are marketed.

e. Dilution rates.

(1) Mix dry milk replacer with water for feeding.

(2) The liquid replacer as fed, should contain 85-90 percent water.

(3) Use the mixing rates in Table 19.

f. Water temperature.

(1) For ease in mixing, have water temperature at about 110°F.

(2) Put water in the container and slowly stir in the powder with a wire whip.

(3) The temperature should decrease to about 100°F after mixing.

g. Keep replacer dry and clean.

(1) Close milk replacer bags and keep them in a container with a tight cover.

(2) Quality is reduced and replacer may become contaminated with disease organisms if the bag is left open and exposed to light, moisture, air, flies and rodents.

(3) Use only clean feeding equipment.

4.2.16 What feeding method will you select?

a. Most calves are weaned at 5-8 weeks of age.

(1) Regardless of the feeding system, don't wean a calf until it is growing well and is consuming the recommended amount of starter—at least 1 percent of body weight.

(2) Do not wean a calf which is consuming less than the minimum amount of starter at the desired weaning age or a calf which is not growing well.

b. To encourage consumption of starter, feed the calf either milk or milk replacer once per day for 5-7 days before desired weaning age.

c. Limit the amount of forage to encourage starter intake and rumen development.

4.2.17 When can you wean calves early?

a. You can successfully wean calves at 21-24 days of age if they are offered a high-quality starter by 3 days of age and if they are consuming enough starter by the desired weaning age.

b. Many calves weaned this young may not do well for 7-10 days following weaning or until they consume daily at least 2 pounds of starter per 100 pounds of body weight plus forage.

c. Calves must be strong, healthy and consuming adequate amounts of dry feed before they are weaned. Table 22 shows mortality in herds where calves were weaned at 3-4 weeks of age as compared to calves weaned at 7 or more weeks.

4.2.18 How frequently should you feed calves?

a. Most calves are fed two equal feedings per day.

b. Weak calves may benefit from more frequent feedings.

c. If calves are fed three times daily, divide the total milk or replacer fed per day into equal portions. Follow the same routine each day.

d. Once-a-day feeding requires careful management.

(1) Total liquid intake should be limited. Reduce the volume fed to 70 percent of that fed daily with twice-a-day feeding.

(2) However, calves fed once daily should receive about the same amount of dry matter daily as calves fed twice daily.

(3) Once the proper volume has been determined, mix 6 pounds of water (instead of 8 pounds) per pound of dry replacer. If whole milk is used on a once-a-day feeding program, feed 70 percent of the daily amount suggested for twice-a-day feeding and add 4-5 ounces of dry replacer or dry skim milk to each gallon of whole milk.

(4) Observe calves 3 to 4 times daily the first 4 weeks to check on their health.

(5) Once-a-day feeding reduces time required for feeding but may not reduce total labor.

(6) It is certainly no substitute for good management and should only be tried when calves are raised under the best conditions.

(7) Once-a-day feeding may increase the incidence of scours due to high total solids intake at a single feeding or from excessive concentration of solids (Table 23).

4.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Efficiency of absorption of immunoglobulins.
   (2) Key words.
   (3) Feeding methods.
   (4) Composition of colostrum, transitional milk and whole milk.
   (5) Major types of immunoglobulins (IG) and their functions.
   (6) Limited whole milk plan for twice-a-day feeding.
   (7) Milk replacer (MR) plans for twice-a-day feeding.
   (8) Milk replacer.
   (9) Milk replacer.
   (10) Milk replacer.

b. Slides

c. References

   (1) Bringe, A., H. Larsen, G. Tenpas, R. Vilstrup, G. Krueger, J. Andersen. *Calf Management-Birth to Weaning.* University of Wisconsin-Madison Extension, March 1978. A2841.
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   (7) Church, D.C. *Digestive Physiology and Nutrition of Ruminants: Practical Nutrition.* 2nd ed. Corvallis, Oregon: O & B Books, Inc., 1980. Chapter 10.
   (8) Jurgens, Marshall H. *Animal Feeding and Nutrition.* 5th ed. Dubuque, Iowa: Kendall/Hunt Publishing Co., 1982.

4.4 Check-Out Activites.

a. Provide students with the following exercise.

T F 1. One of the most important steps to increase calf survival rates and health is the prompt feeding of colostrum.

T F 2. Once-a-day feeding reduces time required for feeding but may not reduce total labor.

T F 3. Frozen colostrum should be heated to a high temperature before feeding to kill germs.

T F 4. For maximum growth feed calves as much whole milk as they will drink.

T F 5. A calf is born essentially without any immunity to infections and diseases.

T F 6. Calves should be removed from the dam immediately after birth.

T F 7. Do not feed calves the first milk following antibiotics treatment.

T F 8. Immunoglobulin concentration is highest at calving and begins decreasing soon after calving.

T F 9. Milk replacer solutions should contain only 5-10 percent water.

T F 10. Very young calves fed milk replacers are more likely to scour than calves fed whole milk.

T F 11. Performance of calves is a good indicator of the value of milk replacer.

T F 12. Length of the dry period has little or no influence on the concentration of immunoglobulins.

T F 13. Newborn calves that have never nursed learn to drink rapidly.

T F 14. Fermented colostrum should not be fed the first 48 hours after birth because it may cause digestive upsets.

T F 15. A calf loses its ability to absorb immunoglobulins within 2 weeks after birth.

T F 16. The appearance of colostrum is an indicator of its quality.

T F 17. A calf left with a cow for more than 12 hours may butt and damage the cow's udder.

T F 18. Calves fed whole milk are usually not as sleek in appearance as those fed milk replacer.

19. _____ whey should not be fed to calves because it may cause sore gums and tooth decay.

20. _____ is the best source of carbohydrates for calves.

21. Colostrum should be fed to calf within _____ after birth.

22. Fermented colostrum should be stored at a temperature below _____.

23. The energy content of a milk replacer is determined by the amount of _____.
24. Skim milk powder does not contain vitamins A and _____ nor does it contain trace minerals.
25. Passive immunity remains for about _____ after birth.
26. Most calves are fed _____ equal feedings per day.
27. _____ should not be added to stored fermented colostrum because it may prevent bacterial growths and ruin fermentation.
28. True colostrum is the milk from the _____ milking.
29. Milk containing _____ fat will not cause digestive upsets when it is substituted for richer milk.
30. The "rule of thumb" for feeding whole milk is "feed _____ pound of milk per day for each 10-12 pounds of body weight at birth."

Answers

1. True	11. True	21. 30 minutes
2. True	12. False	22. 70°F
3. False	13. True	23. Fat
4. False	14. True	24. D
5. True	15. False	25. 2 months
6. False	16. True	26. Two
7. True	17. True	27. Antibiotics
8. True	18. False	28. First
9. False	19. Acid	29. Less
10. True	20. Lactose	30. One

b. Discussion Questions
(1) How should milk replacer be stored?
(2) What is an esophageal feeder and why is it used?
(3) Why is fermented colostrum not stored in metal containers?
(4) What is the role of antibiotics in milk replacer?
(5) What is the cause of heifer mastitis?
(6) Why is the feeding of colostrum important for calf health?
(7) What is fermented colostrum?
(8) Why is nipple feeding better than using an open bucket?
(9) What is passive immunity?
(10) Briefly outline how you would teach a calf to drink.
(11) Why will some calves not develop passive immunity?

REMINDER TO USERS OF THIS TEACHER'S GUIDE

Transparency masters for all lessons have been placed in the appendix for your convenience. These are in full page form in order that you may make your transparencies directly from them.

5. Feeding Calf Starters

5.1 Performance Objective

Given a written check-out activity concerning feeding calf starters, the student will complete the check-out at a level of accuracy determined by the instructor.

5.2 Teaching-Learning Activities

a. Use resource persons such as university Extension specialists, veterinarians or outstanding dairymen.
b. Develop a feeding program for calf starters using feeds available in the area.
c. Determine the cost of raising replacement heifers.

5.2.1 Tailor feeds to rumen development.

a. The feeds young calves consume must be tailored to rumen development.
b. The newborn calf is essentially a monogastric, a single-stomached animal.
   (1) It lacks a functional rumen and is unable to digest fiber.
   (2) The true stomach (abomasum) is the largest compartment of a new born calf's stomach (Figure 7).
      i. The esophageal groove diverts milk or liquid milk replacer to the abomasum.
      ii. This prevents milk from entering the undeveloped rumen which might lead to undesirable fermentation and cause scouring.
c. Intake of dry feed stimulates rumen development by increasing the numbers of rumen bacteria and protozoa.
d. Offer calves a high quality starter at 3-5 days of age.
   (1) Limit milk or milk replacers to recommended levels (Tables 17 and 19) to encourage intake of starter.
   (2) Calves fed more than recommended amounts of milk or milk replacer will reduce their consumption of starter. This delays rumen development and increases rearing costs.
e. Intake of highly digestible starter stimulates development of the rumen microflora and rumen tissue (papillae).
   (1) These microorganisms grow rapidly and produce volatile fatty acids (VFAs)—acetic, propionic and butxric acids—during fermentation. These acids stimulate papillae development in the rumen.
   (2) The population of rumen microbes must be established before calves are weaned.
f. Calves should be eating at least 1 pound of starter daily per 100 pounds of body weight before they are weaned.
   (1) Calves consuming recommended amounts of starter may be weaned at 4-6 weeks of age.
   (2) Calves will function as a mature ruminant by 4 months of age if the above practices are followed.

5.2.2 Feed calves for good growth

a. Feed calves for good growth, not just for weight gain.
   (1) Excess fat gained during birth to puberty may be deposited in the mammary gland. This reduces the calf's future ability to produce milk.
   (2) Fat heifers of recommended weight are more prone to metabolic disorders and calving problems than well-grown heifers of the same weight.
b. Table 24 shows suggested weights for various breeds of heifers from birth to 4 months.
c. Table 25 shows the average daily gain suggested for Holstein calves from birth to 4 months of age.

5.2.3 Feed calves for health and vigor

a. A feeding program should result in weaned calves that are healthy and strong.
   (1) A feeding program should result in weaned calves that are healthy and strong.
   (2) Calves are often overfed in an attempt to induce rapid growth.
   (3) Overfeeding causes indigestion, as indicated by scouring (diarrhea), which severely retards growth.
b. Table 26 shows the nutrient requirements of dairy calves as suggested by the National Research Council (N.R.C.)

5.2.4 When do you start calves on dry feed?

a. The first dry feed offered to calves is starter.
   (1) Starter is a very palatable, coarse-textured or pelleted concentrate.
   (2) It should contain 75-80 percent TDN and 15-20% crude protein.
b. There are two types of starters.
   (1) Grain starters are fed with forages.
   (2) Complete starters contain forages.
      i. Many dairymen prefer a complete starter especially those who raise large numbers of calves.
      ii. Since calves can't select among feedstuffs, it is easier to control their intake of concentrate and forage and to make sure all calves consume both concentrate and forage when you feed a complete starter.

(3) Tables 27 and 28 show examples of ingredients used in starters.

c. Teaching calves to eat starter.
   (1) You should encourage calves 3-4 days of age to eat some starter.
   (2) Encourage a calf to eat by placing a handful of starter in a milk pail or on the calf's muzzle immediately after it has finished drinking milk.
   (3) All calves should be eating some starter at 7-10 days of age.
   (4) Feed small amounts of fresh starter daily.
      i. Remove any uneaten feed daily.
      ii. Adjust amount of starter fed to amount consumed.

d. Feeding a grain starter.
   (1) Feed as much grain starter as a calf will eat until starter intake reaches 4-5 pounds daily.
   (2) Offer forage free choice with starter a week before calf is weaned.

e. Feeding a complete starter.
   (1) A complete starter is fed free choice.
   (2) Additional forage will not be fed until a calf is about 3 months of age.

f. Either type of starter should be fed to calves until they are 4 months of age. Then feed a growing ration containing grain and forages.

5.2.5 Starter quality is important.

a. The growth of young calves depends on starter intake.
   (1) Unpalatable or poor quality starter will decrease intake, retard rumen development and decrease calf growth.
   (2) A coarse mixture is preferred since texture is a major factor affecting palatability.
      i. Farm grains used in starters may be coarsely ground, rolled or crushed.
      ii. Whole oats and corn are satisfactory.
      iii. High-moisture grains are also satisfactory, but don't let them heat or mold in mangers.
      iv. When feeding high-moisture grains, feed small amounts frequently and remove any leftover material regularly.
   (3) Researchers have found no significant difference between pelleted and coarsely ground starters, although some dairymen may prefer one type.
      i. Coarse meals, pellets or a mixture of the two types are satisfactory for most calves.
      ii. Added micronutrients are more uniformly mixed when starters are pelleted.
      iii. Adding liquid molasses improves palatability, reduces separation of micronutrients and reduces wastes.

b. Energy.
   (1) Young calves need dry feed containing large amounts of readily digestible energy.
      i. Their rumens lack the microbial population required to digest crude fiber.
      ii. A readily fermentable feed improves microbial growth and fosters rumen development.
   (2) Complete starters may contain as much as 35 percent good quality forage.
      i. Beet pulp, soybean hulls and early cut alfalfa are good quality forages.
      ii. Complete starters should not contain more than 15 percent total crude fiber or about 18-19 percent acid detergent fiber (ADF).

c. Protein.
   (1) Both types of starters should contain 15-20 percent crude protein. High-quality plant protein is adequate since the calf receives animal protein from milk or milk replacers.
   (2) Calves weaned at 3-4 weeks of age should be fed starters containing more high-quality protein.
   (3) Starters containing 15-16 percent crude protein are adequate for calves more than 6 weeks of age that are still consuming milk or milk replacer.
   (4) Do not feed young calves urea or other sources of nonprotein nitrogen.
   (5) At 4 months of age, calves become growing heifers and have functional rumens.
      i. They can then be fed a growing ration.
      ii. This may be the same grain and forage fed to the milking herd.

d. Vitamins and minerals.
   (1) Most commercial calf starters are fortified with vitamins A, D, and E. Young calves need these vitamins in the starters since their forage intake and exposure to sunlight are not sufficient to ensure adequate vitamin intake.
   (2) Commercial starters also contain minerals, a calcium-phosphorus source, salt and trace minerals. Provide a source of selenium if signs of selenium deficiency, such as white muscle disease, have been observed.

e. Antibiotics.
   (1) Many starters contain antibiotics.
      i. Antibiotics are not needed in starters, although they are frequently used when whole milk or some colostrum is the liquid feed.
      ii. If the milk replacer contains antibiotics, do not use a starter containing antibiotics.

(2) Ten to 15 milligrams of chlortetracycline (Aureomycin) or oxytetracycline (Terramycin) per pound of starter is a typical level.

i. Follow label instructions when feeding starter containing antibiotics.

ii. Pay careful attention to suggested antibiotic withdrawal times if calves are marketed for slaughter.

5.2.6 When do you feed calves forages?

a. Calves fed a complete starter do not need to be fed additional forages. However, feed calves forages for 2-3 weeks before starter is discontinued.

b. Calves fed a grain starter may be offered forages at any time, but they should consume some forage for at least a week before they are weaned.

c. The growth and development of the rumen and nutrient intake of young calves depends more on grain intake than on forage intake.

d. Alfalfa or alfalfa-grass hay is the forage most commonly fed to calves.

(1) Hay can be long, chopped, ground or pelleted.

(2) Chopped or pelleted hay is easier to handle and less wasteful.

(3) Calves tend to waste long hay.

(4) Chopped hay is often dusty.

e. Very young calves can be fed high-quality corn silage and hay-crop silage.

(1) It is difficult to keep silage fresh and palatable.

(2) Regularly remove from manger silage that heats or molds.

(3) On most farms dry hay is a more convenient source of forage than silage for young calves.

5.2.7 How fast should heifers grow?

a. Large-breed heifers should weigh 800-875 pounds at 15 months of age.

(1) Heifers bred at that weight and age will calve at 24 months of age.

(2) Holstein and Brown Swiss heifers should weigh 1,150-1,200 pounds at 22 months of age (2 months before calving). See Table 30.

(3) To reach that weight, large-breed heifers should gain an average of 1.7 pounds daily (50 pounds per month) during the period from 3 months of age to 2 months before calving.

b. Comparable figures for Guernsey or Ayrshire heifers are 1.5 pounds daily or 45 pounds per month.

c. Jersey heifers should gain an average of 1.3 pounds daily (40 pounds per month).

d. Feed heifers so they reach the recommended breeding weights when 14-16 months old (Table 30).

e. A general guideline is to breed heifers when they reach 60 percent of their mature milking weight.

f. Overfed heifers have adequate weight at a younger age but lack skeletal growth.

(1) Large-breed heifers 11 or 12 months old that weigh 800-850 pounds will be overly fat.

(2) Although these fat heifers have reached breeding weight, they lack sufficient bone growth, particularly in the pelvic area, and will have difficulty calving if bred at that time.

(3) Excessively fat heifers may also have lower conception rates.

(4) The amount of milk secretory tissue may be reduced when fat is deposited in the developing udder.

(5) Excess weight is more damaging to heifers before puberty than after they are bred.

g. Although heifers should not be overfed, they should not be underfed either.

(1) Large-breed heifers reach puberty, the onset of estrus, when they weigh about 600 pounds.

(2) If heifers are underweight, onset of estrus will be delayed. This eventually delays breeding and calving.

(3) With the right rations it is possible to feed heifers so they have adequate weight and growth for breeding at 14-15 months of age.

5.2.8 Monitor heifer growth.

a. Check weight gains of heifers to determine whether heifers are growing so they can be bred and will calve at the desired ages.

(1) Periodically checking weights of heifers also helps you evaluate your feeding program.

(2) Use a scale or a tape to monitor heifer weight gains.

b. Observe body condition and skeletal growth.

(1) Overconditioned heifers may be receiving too much feed or the ration may be low in protein.

(2) Lack of condition indicates underfeeding or poor-quality feed.

c. Adjust the feeding program before improper growth rates harm heifers.

5.2.9 Balance heifer rations according to stage of growth.

a. The nutritional requirements of heifers change as they mature.
   (1) Younger heifers lack the rumen capacity to maintain satisfactory weight gains if they are fed only forage.
   (2) Older heifers have sufficient rumen capacity for adequate growth when fed only good-quality forage rations.
      i. Older heifers will gain an excessive amount of weight if high-energy forages, such as corn silage, are fed free choice.
      ii. A combination of corn silage and alfalfa limits energy intake and provides adequate protein.
      iii. You can use high-moisture corn (either ground ear corn or shelled corn) in place of dry grains in rations for growing heifers. It is an excellent feed for growing heifers when included in a balanced ration.

b. Table 32 shows suggested nutrient specifications and dry matter intake for heifers in four age groups.
   (1) Total dry matter intake of older heifers, as a percentage of body weight, decreases as forage intake increases.
   (2) Dry matter intake of 200-pound heifers on forage and grain is about 3 percent of body weight while that of 1,100-pound heifers fed mostly forage is about 2 percent of body weight.
   (3) Table 33 shows how a decrease in forage quality increases the amount of grain that must be fed.

c. Heifers that are gaining weight when bred have higher conception rates. Feed extra grain to heifers on poor-quality pastures or those fed poor-quality hay or other poor-quality forages so they are gaining weight at breeding time.

d. Tables 34, 35 and 36 show several rations for heifers from 4 months through breeding age.

5.2.10 Heifer rations for feeding from breeding to calving vary according to feed choice.

a. A deficiency of energy is not usually a problem unless the total ration is corn stalks, poor-quality hay or pasture. These feedstuffs are usually deficient in both energy and protein.

b. Excellent quality forage will provide the protein and energy needed by bred heifers.
   (1) A ration consisting of one-third to one-half legume hay or silage and one-half to two-thirds corn silage contains adequate levels of protein and energy.
   (2) Feed 2-3 pounds of grain mixture daily if bred heifers are fed average-quality legume or legume-grass forages.

c. Corn silage is low in protein and high in energy.
   (1) Heifers fed a ration consisting largely of corn silage are likely to grow poorly and become excessively fat.
   (2) Limit amount of corn silage and feed supplemental protein if corn silage makes up more than two-thirds of the ration.

d. Offering calcium-phosphorus mineral and trace mineral salt free choice is a common method of providing heifers with adequate minerals.

e. Table 37 shows several rations for bred heifers.
   (1) There is little difference in the composition of these rations.
   (2) Any one of them will maintain desired growth rate for heifers.

f. Overall feed quality and a feeding system that assures adequate intake are essential.

g. Tables 36 and 37 show that extra protein and energy (protein supplement and grain) are needed when low-quality forages are fed.

5.2.11 Group heifers by age and size.

a. Differences in the nutrient requirements and feed intake at different stages of growth are some of the reasons heifers of approximately the same weight and size should be grouped together.

b. The number of heifers in a group varies with the size of herd and number of heifers raised.
   (1) Small groups of heifers (10-15) are easier to observe and control.
   (2) A timid or poor-growing heifer is easier to spot in a small group and can be separated for special attention.
   (3) Older heifers fed total mixed rations free choice are often raised in larger groups.

c. It is important to observe grouped heifers regularly and separate those that are not doing well.

5.2.12 What is the cost of raising replacement heifers?

a. Use the amounts of feed shown in Table 38 to estimate how much it costs you to feed replacements.
   (1) The costs of raising dairy heifers depend on the price of feeds, age at calving, quality of forages, death losses, culling percentages and other fixed and variable costs.

(2) On most farms, rations based on high-quality forages will reduce feed costs and maintain good growth.
(3) Balancing rations for different age groups can significantly lower feed costs.

b. Use Tables 38 and 39 to estimate feed costs.
(1) Include feed costs from Table 38 when determining the total cost of raising replacements in Table 39.
(2) Your actual costs will vary by area, current prices and facilities.

c. Feed cost is about half the cost of raising replacements.

d. Also consider the initial cost of a calf, whether purchased or from your herd, and a reasonable charge for death losses to obtain a realistic value for a freshening heifer.

5.2.13 Do calves need water?

a. Provide calves with plenty of fresh water.
(1) Pail feeding is best.
(2) Water can be provided when calves are less than 1 week old.
(3) Until calves are 3 weeks old, do not feed water just before feeding milk or milk replacer.

b. Pail feed fresh water until calves adjust to free choice water. Drinking cups may then be used.

5.2.14 Do growing calves and heifers need supplemental vitamins?

a. Calves are born with little or no reserves of the fat-soluble vitamins A, D and E.

b. Colostrum is high in vitamin A activity and the other fat-soluble vitamins.

c. Weak newborn calves, purchased calves or those born in a disease-infested environment will benefit from intramusclar injections of vitamins A, D and E. Consult your veterinarian.

d. The vitamin concentration of colostrum depends on how pregnant cows are fed.

e. Rations of dry pregnant cows should be supplemented with at least 50,000 I.U. of vitamin A and 25,000 I.U. of vitamin D daily.

f. Supplemental vitamins are not necessary for cows on good pasture, but are recommended if cows are fed stored or fermented feeds year round.

g. A deficiency of vitamin A decreases a calf's resistance to disease, particularly scours and pneumonia.

h. Tables 27, 28 and 29 show that vitamins A and D should be added to grain and complete starters.

i. Most dry commercial starters and milk replacers contain vitamins A, D and E.

j. High-quality dry forages are a good source of carotene (the precursor of vitamin A) and vitamins D and E as well as the water-soluble vitamins. The carotene content of forages decreases over time and with fermentation.

k. To make sure heifers receive enough vitamin A, provide at least 3,000 I.U. of vitamin A daily per 100 pounds of body weight.

l. Vitamin D helps calves utilize calcium and phosphorus for bone development. Direct sunlight and sun-cured hay are natural sources of vitamin D. Feed 300 i.U. of vitamin D daily per 100 pounds of body weight.

m. Whole milk and milk replacers usually contain adequate amounts of the water-soluble vitamins (B complex vitamins).

n. Once a calf starts to eat dry feed and fermentation develops in the rumen, rumen bacteria start to synthesize B vitamins.

o. Rumen synthesis and feeds usually supply adequate amounts of B vitamins for growing calves and heifers.

5.2.15 Do growing heifers need salt and supplemental minerals?

a. Salt and other minerals are extremely important in good growth.

b. Salt must be provided for all livestock.

c. Wisconsin feeds are low in iodine. In some areas, cobalt is also lacking.

d. Trace mineral salt contains adequate amounts of these and other trace minerals—iron, copper, manganese and zinc.

e. A trace mineral salt should also contain selenium if white muscle disease is a problem or you are in an area known to be deficient in selenium.

f. Calves require large amounts of calcium and phosphrous, but the feeding methods recommended in this publication will provide adequate amounts of these minerals.

g. Milk is a good source of both calcium and phosphorus.

h. The suggested starters and commercial calf feeds are fortified with these minerals.

i. Legume hays are rich in calcium. Older calves consuming legume hay or legume silage will receive plenty of calcium.

j. Concentrates, especially the high-protein feeds, are rich in phosphorus. When one-fourth of the grain ration is made up of protein supplements like soybean oil meal or other commercial protein supplements, 3-4 pounds of the grain mix will provide adequate phosphorus.

k. A phosphorus supplement will be needed as calves grow older and are fed largely roughages and limited grain. Include 1 percent steamed bonemeal, dicalcium phosphate or commercial mineral of similar composition in home-mixed feeds in addition to providing mineral free choice. This will insure ample calcium and phosphorus.

5.2.16 What kinds of bedding are best?

a. Clean dry straw or sawdust are preferred for young calves.
b. Older animals can be bedded with chopped corn stalks, ground ear cobs, wood shavings, ground bark or combinations of these materials.

5.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Grain starter—complete starter.
   (2) Grain starters.
   (3) Complete starters.
   (4) Weight gain depends on starter intake.
b. Slides
c. References
   (1) Hoard, W.D. *Hoard's Dairyman Calf Care and Raising Young Stock.* Fort Atkinson, WI: W.D. Hoard and Son, Co., 1979.
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5.4 Check-Out Activities

a. Provide students with the following exercise:

T F 1. The newborn calf is essentially a monogastric.
T F 2. Calves shouldn't be fed starter until they are at least 6 months of age.
T F 3. The major purpose of feeding is for weight gain.
T F 4. Overfeeding calves is a good practice to ensure calves achieve maximum growth.
T F 5. Young calves need to be fed energy in a readily digestible form because their rumens lack the microbial population to digest crude fiber.
T F 6. White muscle disease is a sign of vitamin D deficiency which often occurs if exposure to sunlight is insufficient.
T F 7. Antibiotics are not needed in starters.
T F 8. Heifers should be fed so they reach the recommended breeding weight by 14-16 months of age.
T F 9. To ensure that older heifers will gain rapidly high energy forages should be fed free choice.
T F 10. Nutrient requirements of heifers change as they mature.
T F 11. Heifers that are gaining weight when bred have a higher conception rate.
T F 12. The nutrient content of a balanced cow ration will not meet the growth requirements of heifers from 13 months of age until 2 months before calving.
T F 13. Small groups of heifers (10-15) are easier to observe and control.
14. Feed cost is about _____ the cost of raising replacements.
15. The _____ is the largest compartment of a newborn calf's stomach.
16. Calves will function as a mature ruminant by _____ months of age if proper practices are followed.
17. _____ starter is preferred by most dairymen because it is easier to control the calves' intake of concentrate and forage.
18. _____ is a major factor affecting palatability of starters.
19. Intake of dry feeds by a young calf stimulates _____ development.
20. Starters should contain _____ _____ crude protein.
21. A _____ in forage quality will need to be offset by a _____ in the amount of grain fed.

22. Name several factors that influence the cost of raising dairy heifers._____

_____

23. Name the two types of starters.

_____

_____

Answers

1. True	8. True	15. Abomasum
2. False	9. False	16. 4
3. False	10. True	17. Complete
4. False	11. True	18. Texture
5. True	12. False	19. Rumen
6. False	13. True	20. 15-20%
7. True	14. 50%	21. Decrease, increase

22. Price of feeds, age at calving, quality of forages, death losses and culling percentages.
23. Grain and complete starters.

b. Discussion Questions:

1. What is meant when we say that a newborn calf is essentially a monogastric?
2. What is the function of the esophageal groove?
3. Why it is important to encourage intake of a starter by the young calf?
4. What problems are encountered when heifers are overweight?
5. What is a starter? Briefly describe the two types.
6. Why should only small amounts of a starter be fed daily?
7. What effects will a unpalatable or poor quality starter have on a calf?
8. Why is liquid molasses added to starters?
9. Why should young calves not be fed urea or other sources of nonprotein nitrogen?
10. Why is dry hay a more convenient source of forage for young calves than silage?
11. Why is it important to monitor heifer growth?
12. Why should heifers be grouped by age and size?

6. Calf Management Jobs

6.1 Performance Objectives

Given a written check-out activity concerning calf management jobs, the student will complete the check-out with 75 percent accuracy in the activity.

6.2 Teaching-Learning Activities

a. Use resource persons such as university Extension specialists, veterinarians or outstanding dairymen.
b. Visit an area farm to observe demonstrations of identifying calves, dehorning, removal of extra teats, etc.
c. Students will perform various calf management jobs under guidance of the instructor.

6.2.1 Identification is important.

a. Positively identify each calf before removing it from the dam.
b. Permanent identification is required to register purebred calves and is essential for a good breeding program.
c. Breed associations will furnish registration forms and permanent identification requirements.

6.2.2 What do you use for temporary identification?

a. Use a neck strap or chain with a number or metal or plastic ear tag.
b. Enter ear tag or registration numbers of calves, sires and dams and birth dates in a permanent record book.

6.2.3 What do you use for permanent identification?

a. Photographs and sketches.
   (1) Used for cattle breeds when each animal has distinct color markings.
   (2) A photograph or sketch is required to register broken-color breeds (Holsteins, Guernseys and Ayrshires).
b. Tattoo.
   (1) Tattoo marking inside the ear is required to register solid-color breeds (Jerseys, Brown Swiss and Milking Short-horns).
   (2) Use good-quality ink and place the tattoo mark between the ribs of the upper half of the ear. Remove wax and avoid hairy areas. Use black ink on light-colored ears and red ink on dark-colored ears.
   (3) Apply a generous amount of ink with a toothbrush to the numbers or letters and the ear surface.
   (4) Holding the ear between the thumb and fingers, puncture and push the ear away from the points of the instrument as you release the pressure.
   (5) Immediately rub additional ink into the puncture.
   (6) A well-applied tattoo should last throughout the life of the animal.

(7) Examine the ear when heifer is about 1 year old. You can apply another tattoo, following breed association requirements, if necessary.

c. Freeze branding.
   (1) Applying a super-cold branding iron to the skin destroys the pigment cells that produce dark hair.
   (2) White hair grows where the iron was applied.

6.2.4 How do you remove extra teats?

a. A good udder with four well-placed teats is important.
b. Extra teats on a cow's udder are unsightly and may become a site for infection and may interfere with machine milking.
c. Extra teats should be removed as soon as they can be positively identified. It is best to remove extra teats when a heifer calf is 2-6 weeks old and is still easy enough to handle.
d. Procedure for removal of extra teats:
   (1) Tie the calf securely.
   (2) Clean and disinfect the teat and surrounding area with iodine or other reliable disinfectants.
   (3) Draw the teat down and snip the teat off cleanly at the line where the teat joins the udder.
   (4) Use a serrated shears for an accurate cut.
   (5) Swab the area with a disinfectant after the operation.
   (6) There is seldom any bleeding.
   (7) Apply a fly repellent to the wound during fly season.
e. Removal of extra teats on older heifers should only be done by an experienced herdsman or veterinarian since the wound may be so large that stitches will be needed to close the skin for proper healing.
f. Make sure the teat is "extra." A heifer will freshen with only three normal teats if the wrong teat is removed. If in doubt leave the extra teats until they can be positively identified.

6.2.5 There are several methods of dehorning.

a. Horns serve no useful purpose on dairy cattle; they can be a nuisance and cause body and udder injury. Dehorn all breeds of dairy cattle.
b. Horns do not improve general appearance and are seldom seen on the best show cows.
c. Properly dehorning with a caustic stick or an electric dehorner when horn buttons are very small can be a neat, clean job that causes little discomfort to the animal.
d. Caustic stick.
   (1) Dehorn when a calf is 4-10 days old, or as soon as the horn buttons can be easily detected.
   (2) Remove hair from the horn buttons.
   (3) Protect your fingers by wrapping paper around the caustic stick or by wearing rubber gloves.
   (4) Moisten the caustic stick and rub it vigorously over the horn button in a circular motion.
   (5) When the skin softens, repeat the procedure on the other horn and return to the first horn.
   (6) When enough caustic has been applied, the skin will have softened so it can be easily broken with the end of the caustic stick.
   (7) Be careful with caustic! It is not necessary to take off the entire horn at the time of the operation since the caustic will continue to work and destroy the horn.
   (8) Place a ring of vaseline or grease around the horn button following caustic application so caustic doesn't get on a calf's face and eyes.
   (9) Keep calves in individual pens so caustic does not rub off on other calves.
   (10) Store caustic in a sealed glass or plastic container. Label it clearly and keep it in a dry place that is not accessible to children or animals.
e. Electric dehorners.
   (1) Electric dehorners are similar to large soldering irons with hollowed tips that fit over the horn.
   (2) For best results, calves should be dehorned when about 1 month of age.
   (3) Follow directions supplied with the electric dehorner.
   (4) Place the hot iron over the horn button to burn away skin around the horn.
f. Gouge or scoop—gouging out the horn button causes excessive bleeding and invites serious unnecessary infections.
g. Saw or horn clipper.
   (1) Horns may be removed with a saw or clippers if horn growth was not prevented at a young age.
   (2) Do not use saw or horn clippers until an animal has reached an age when horns will not regrow (usually more than 15 months).

6.2.6 Disinfect navel at birth.

a. This protects a young calf against infections which enter through the navel.
b. Use 7 percent tincture of iodine.

6.2.7 Keep feeding utensils clean.

a. Dirty feeding pails are disease carriers.
b. Use easy-to-clean utensils and disinfect with a milk utensil disinfectant or rinse utensils in very hot water after wash ng.
c. Keep feeding boxes clean and sanitary.

6.2.8 Keep calf pens clean.

a. Dirty bedding harbors disease germs.
b. Clean, dry and well-bedded pens help keep calves healthy and comfortable at little cost.

6.2.9 Supply fresh air—but no drafts.

a. Adequate ventilation is needed to remove excess moisture.
b. Drafts may cause colds and lead to pneumonia.

6.2.10 Sanitation is important.

a. It is easier to prevent infectious diseases than to cure them.
b. When large numbers of calves pass through a rearing facility, there is a gradual increase in infections caused by bacteria and viruses.
c. Prevent diseases and infections with a "sterilization break" of about 6 weeks and by thoroughly cleaning and disinfecting facilities between groups of calves.
   (1) Clean stalls and pens thoroughly between calves by scrubbing walls, partitions, stanchions and floors.
   (2) Sanitize with a lye solution or other strong disinfectant.
d. Clean calf hutches and add fresh bedding between calves.
   (1) In the summer, move vacant hutches to fresh ground.
   (2) Return hutches to a protected area for the winter.
e. You can control or prevent digestive disorders, one of the common calf ailments, by a strict sanitation program.
   (1) Scrub utensils after each use.
   (2) Clean food boxes daily.

6.2.11 Isolate sick calves.

a. You should isolate abnormal or sick calves and get their condition diagnosed.
b. Isolation can prevent the spread of infectious diseases to other calves.

6.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Diagrams for color markings
b. Slides
c. References

(1) Bath, Donald L., Frank N. Dickinson, H. Allen Tucker, Robert D. Appleman. *Dairy Cattle: Principles, Practices, Problems, Profits.* 2nd ed. Philadelphia: Lea and Febiger, 1978.
(2) Bringe, A., H. Larsen, G. Tenpas, R. Vilstrup, G. Krueger, J. Andersen. *Calf Management-Birth to Weaning.* University of Wisconsin-Extension, March 1978. A2841.
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(5) Hoard, W.D. *Hoard's Dairyman Calf Care and Raising Young Stock.* Fort Atkinson, WI: W.D. Hoard and Son, Co., 1979.
(6) Olson, C.C. *Use DHI Records to Keep Track of Your Calves.* University of Wisconsin-Extension, March 1978. A2815.

6.4 Check-Out Activities

a. Provide students with the following exercise:

T F 1. Positively identify calves before removing them from their dams.
T F 2. Temporary identification can be used to register purebred calves.
T F 3. A well-applied tattoo should last throughout the life of the animal.
T F 4. Sick calves should be isolated from other calves to prevent spread of infectious disease.
T F 5. Removal of extra teats on heifers should not be done until the teats can be positively identified.
T F 6. Gouging out the horn buttons is a safe and extremely effective method of dehorning cattle.
T F 7. A sterilization break between groups of calves is unnecessary unless there was evidence of disease in the previous group of calves.
T F 8. Disinfecting a calf's navel at birth helps to protect the animal against infection which might enter through its navel.
T F 9. It is easier to cure diseases than to try to prevent them.
10. _____ serve no useful purpose on dairy cattle and often can cause body and udder injury to other cows.

11. Use _____ _____ to dehorn a calf at 4-10 days old or as soon as you can easily detect the horn button.
12. Adequate ventilation is needed to remove excess _____.
13. Dehorning with a saw should be done in the _____ to avoid contamination by flies.
14. _____ _____ is the application of a super-cold branding iron to the skin which destroys the pigment cells that produce dark hair.
15. For best results with an electric dehorner, calves should be dehorned at what age?
16. Label each of the following as either a temporary or permanent form of identification.
    a. Neck Chain _____
    b. Freeze Branding _____
    c. Sketch _____
    d. Ear Tag _____

Answers

1. True
2. False
3. True
4. True
5. True
6. False
7. False
8. True
9. False
10. Horns
11. Caustic stick
12. Moisture
13. Winter
14. Freeze branding
15. One month
16. a. temporary
    b. permanent
    c. permanent
    d. temporary

b. Discussion
   (1) Why should extra teats be removed?
   (2) What precautions should be taken for the operator and calf when using a caustic stick to dehorn?
   (3) Describe the procedure for taking heart girth measurements?
   (4) Why is it important to keep feeding utensils and calf pens clean?

7. Keep Calves Healthy

7.1 Performance Objectives

Given a written check-out activity concerning keeping calves healthy, the student will complete the check-out at a level of accuracy determined by the instructor.

7.2 Teaching-Learning Activities

a. Use resource persons such as university Extension specialists, veterinarians or outstanding dairymen.
b. Have students research and report on a calf disease or ailment.

7.2.1 It is important to keep calves healthy.

a. The period immediately after birth and the first few days of life are critical times for calves.
b. It is far better to prevent diseases and ailments than to try to correct them after they occur.
c. Always be on guard to keep diseases from getting started.
   (1) Feed calves correctly.
   (2) Provide clean, wholesome surroundings.
   (3) Isolate sick calves from healthy calves and promptly treat problems early.

7.2.2 Calf scours are a complex disease problem.

a. Scours are most likely to be a problem in calves less than one month old.
b. Calf scours are a complex disease problem since they can be caused by several types of bacteria and viruses.
c. Poor nutrition and management make calves more susceptible to infectious agents which cause scours.
d. Bacterial causes of calf scours are:
   (1) *Escherichia coli* is the most common bacterial organism associated with calf scours.
   (2) *Salmonella spp.* There are several types of *salmonella* and many types may cause scours. *Salmonella typhimurium* is the most common *salmonella* bacteria associated with scours.
   (3) *Clostridium perfringens Type C.* This bacteria is a soil organism and causes scours on many farms.
e. Viral causes of calf scours include:
   (1) *Rota-virus*
   (2) *Corona-virus*
f. Overfeeding, poor quality milk replacers and *coccidia* may cause scours.

7.2.3 How do you treat calf scours?

a. The principal damage caused by diarrhea is loss of water, and bicarbonate, and sodium and potassium ions from blood and body fluids.
b. When the scour-causing agent irritates the intestines the calf's body tries to neutralize, destroy and flush out the irritant.
c. The feces of calves with scours may contain 5-10 times as much water as normal.

d. A calf becomes dehydrated when the extra water is removed from its body and may die within a few hours due to dehydration and/or increased acidity of the blood.
e. Treat calf scours as soon as detected:
(1) Do not feed the calf any milk. Milk encourages the growth of bacteria in the intestine and further complicates the situation.
(2) Feed an electrolyte solution instead of milk. You can purchase packets of electrolytes from veterinarians or farm supply stores. Homemade electrolyte solutions are nearly as effective.
i. A simple electrolyte formula:
1 teaspoon table salt
2 teaspoons baking soda
2 quarts water
ii. A more complete electrolyte formula:
1 package MCP pectin
1 teaspoon low-sodium table salt
2 teaspoons baking soda
1 can beef consomme soup
Mix the ingredients and fill container to 2 quarts with water
(3) The calf should receive 2 quarts of the solution 3 or 4 times a day.
(4) A calf will usually drink or nurse the electrolyte solution when given it instead of milk.
(5) If not consumed, force-feed with a stomach tube or esophageal feeder which can be purchased from veterinarians.
(6) Gradually replace the electrolyte solution with milk as the calf recovers.
(7) Each day give the calf an oral scour medication which contains antibiotics.
(8) Always provide sick animals with a warm, dry place.
(9) Isolate sick calves.

7.2.4 There are several causes of pneumonia.

a. Pneumonia is the major health problem in calves after one month of age.
b. Poor ventilation and constant exposure to pneumonia-producing organisms make calves more prone to pneumonia.
(1) Manure gases in poorly ventilated buildings reduce the ability of a calf's natural body defenses to resist pneumonia organisms.
(2) Constant exposure to large numbers of these organisms, as when healthy calves are penned with infected calves, can "overwhelm" a healthy calf's resistance.
c. Organisms causing pneumonia include:
(1) *Pasteurella multocida* and *Pasteurella hemolytica*
i. These bacterial organisms are frequently found in the nasal passages of cattle.
ii. They often follow other infectious agents and cause severe lung damage which is difficult to repair.
(2) *Chlamydia*
(3) *Mycoplasma dispar*
(4) *Para influenca-3* (PI-3) *virus*
(5) Infectious Bovine Rhinotracheitis (*IBR*)
(6) Bovine Virus Diarrhea (*BVD*)
(7) Adenoviruses
(8) Rhinoviruses
(9) *Haemophilus somnus*

7.2.5 How do you treat pneumonia?

a. Successful treatment of calf pneumonia requires early diagnosis.
b. Calves are usually at least 1 month of age when they show signs of pneumonia, but calves 1-3 weeks of age may be afflicted.
c. A calf's temperature is the best indication of whether it is sick.
(1) Normal rectal temperature is 101-102°F.
(2) A temperature of 105°F or higher often indicates a pneumonia problem.
(3) Antibiotic treatment is usually suggested for calves with elevated temperatures.
(4) Continue treatment at least 1 day after the temperature returns to normal.
d. Sulfamethazine may be added to the feed as a long-term treatment when calves have recovered from the acute phase of pneumonia.
e. Fresh air and sunshine often aid recovery.

7.2.6 There are two basic methods to help prevent disease.

a. There are two basic methods which will help prevent a disease—limit or avoid exposure of an animal to a disease and proper immunization.
b. Preventive procedures include:
(1) Sanitation—maintain clean calving locations, calf pens and feeding utensils.
(2) Colostrum—feed calves colostrum as soon after birth as possible.
(3) Proper ventilation helps keep bedding dry and minimizes manure gases.
(4) Individual pens help prevent disease organisms from spreading by contact. Calf hutches are excellent for raising calves.
c. Vaccination program
(1) Vaccines are available to prevent many diseases (Tables 39 and 40).
(2) Vaccines should not be used without a veterinarian's recommendation and approval.
(3) The list of approved vaccines frequently changes as old ones are dropped and new ones are added.

7.2.7 How do you treat ringworm?

a. This skin disease caused by a fungus infection does not cause any economic losses although circular areas of hair loss (most often on the head and neck) are unsightly.
b. Ringworm lesions generally heal without treatment in 2-3 months.
c. Topical treatment with fungicides will hasten recovery.
d. The dewormer Thiabendazole is also a fungicide. Deworming with this product may also be effective against ringworm.

7.2.8 How do you treat warts?

a. These raised skin lesions caused by a virus normally fall off after 2-3 months without causing any problems.
b. Small warts can be surgically removed with a scissors by cutting them off as close to the base as possible.
c. A wart vaccine may help clear up warts more quickly.

7.2.9 How do you treat bloat?

a. Bloat is an abnormal accumulation of gas in a calf's stomach, usually caused by abnormal fermentation.
b. The accumulated gas must be released immediately.
c. In severe cases, release gas with a stomach tube, trocar or large needle.
d. Evaluate the diet to determine if more roughage is needed and if the ration should be changed to alter fermentation.

7.2.10 How do you treat navel hernias:

a. This is a condition in which the abdominal wall at the navel does not close properly.
b. Most navel hernias are caused by an infection of the navel. Absesses of the navel are similar in appearance to navel hernias.
c. A veterinarian should examine any abnormality of the navel to determine possible treatment or surgery.

7.2.11 How do you treat contracted tendons?

a. This condition is noticeable at birth. The toes on an affected calf are pulled back so the calf walks with its hoof knuckled under.
b. The condition is often corrected without treatment.
c. More severe cases may require splinting and cutting the tendons to get the foot in the proper position.
d. Causes of contracted tendons are unknown.

7.2.12 How do you treat pinkeye?

a. Pinkeye, caused by a bacterial organism, is characterized by a reddening and swelling of the eye membranes and by a watery discharge from the eye.
b. More severe cases may result in corneal opacity (white color) and may even rupture the eye.
c. Treat cases promptly with antibiotics and shield the affected eye from sunlight with eye patches. If animals can be kept inside, patches are not necessary.
d. Control faceflies since they often spread the disease.
e. IBR, eyeworms and other organisms may also cause eye lesions.

7.2.13 How do you treat colic?

a. Calves sometimes develop abdominal pain due to overeating, drinking cold water and many other causes.
b. Colic usually abates within a couple of hours.
c. Prevention may require changing calf nutrition or management practices.

7.2.14 How do you treat internal parasites?

a. Calves raised in clean confinement facilities usually need not be dewormed.
b. However, calves raised in unsanitary conditions may become heavily infected with *trichostrongylus* and may require deworming.
c. *Coccidiosis* may also occur when sanitation is poor.
   (1) It is characterized by loose stools and fresh blood in droppings.
   (2) A veterinarian can examine feces to determine if *coccidiosis* is present.
d. Follow a deworming program for pastured animals since they are likely to become infected with stomach worms.

7.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Scours
   (2) Vaccines to consider for routine use
b. Slides
c. References
   (1) Andersen, J.R., A. Bringe.*Calf Scours—How to Diagnose, Treat and Prevent.* University of Wisconsin-Extension, January 1980. A0442.
   (2) Andersen, J.R. *Prevent Calf Pneumonia.* University of Wisconsin-Extension, April 1980. A2661.

(3) Bringe, A., H. Larsen, G. Tenpas, R. Vilstrup, G. Krueger, J. Andersen. *Calf Management-Birth to Weaning.* University of Wisconsin-Extension, March 1978. A2841.
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7.4 Check-Out Activities

a. Provide students with the following exercise:

T F 1. It is easier to correct diseases and ailments after they have occurred than to try to prevent them.
T F 2. Isolate sick calves from healthy calves to prevent the spread of disease.
T F 3. A calf with scours should be fed milk to help replace the water lost through the feces.
T F 4. Poor ventilation can make a calf more susceptible to pneumonia producing organisms.
T F 5. Vaccines should not be used without a veterinarian's recommendation and approval.
T F 6. Small warts can be safely removed with a scissors.
T F 7. If bloat is a common problem it may be necessary to evaluate the diet to determine if more roughage is needed.
T F 8. Contracted tendons often require surgery to correct.
T F 9. Calves, whether raised in clean or unsanitary conditions, need to be dewormed.
T F 10. Drinking cold water or overeating can cause colic.
11. Pneumonia is most likely to be a problem in calves _____ of age.
12. The best method of detecting health problems early is by using a _____.
13. When is the most critical health period for calves? _____
14. Calf scours can be caused by viruses and _____.
15. Normal rectal temperature is _____.
16. There are two methods which will help prevent a disease. Name one _____.
17. Antibiotic treatment of a calf with an elevated temperature should be continued at least _____ after the temperature returns to normal.
18. Bloat is caused by abnormal _____ in the stomach.
19. _____ is characterized by a reddening and swelling of the eye membranes and by a watery discharge from the eye.
20. Death from calf scours is due to increased acidity of the blood and/or _____.

____ 21. Calf scours
____ 22. Warts
____ 23. Bloat
____ 24. Pneumonia
____ 25. Colic
____ 26. Pinkeye
____ 27. Internal parasites
____ 28. Ringworm
____ 29. Navel hernias
____ 30. Contracted tendons

a. Toes are pulled back so the calf walks with its hoof knuckled under.
b. Caused by an infection of the navel.
c. Pastured animals are likely to become infected by these.
d. Major problem in calves less than one month old.
e. Causes circular areas of hair loss.
f. Abnormal accumulation of gas in the stomach.
g. May be spread by faceflies.
h. Abdominal pain.
i. Raised skin lesions caused by a virus.
j. May cause severe lung damage.

Answers

1. False
2. True
3. False
4. True
5. True
6. True
7. True
8. False
9. False
10. True
11. Over 1 month
12. Rectal thermometer
13. Period immediately after birth and the first few days
14. Bacteria
15. 101-102°F
16. Limit or avoid exposure of an animal or proper immunization
17. One day
18. Fermentation
19. Pinkeye
20. Dehydration
21. d
22. i
23. f
24. j
25. h
26. g
27. c
28. e
29. b
30. a

b. Discussion questions
(1) What is the effect of scours on a calf's body?
(2) What is an electrolyte solution and why is it used in the treatment of calf scours?
(3) What preventive procedures can be taken to help prevent diseases?
(4) What diseases are the most common in the area? Why?
(5) What is the relationship between ventilation and pneumonia?

8. Replacement Housing

8.1 Performance Objectives

Given a written check-out activity concerning replacement housing, the student will complete the check-out at a level of accuracy determined by the instructor.

8.2 Teaching-Learning Activities

a. Use resource persons such as university Extension specialists, veterinarians or outstanding dairymen.
b. Visit and evaluate types of housing systems in your area.
c. Develop an appropriate housing facility for calf management in your area.

8.2.1 Animal housing facilities must be well-designed and properly managed if replacements are to grow well and remain healthy.

a. Housing facilities for calves and heifers must provide:
(1) Adequate space
(2) Dry, draft-free resting areas
(3) Fresh air
(4) Adequate space for feed and water
(5) Space and facilities to group animals by size or age
(6) Sanitary conditions
b. Poorly planned or improperly managed animal housing increases the risk of disease or injury.
(1) Pneumonia, scours and other diseases can permanently damage vital body organs.
(2) Calves and heifers raised in a poor environment may never reach their full genetic potential for milk production.

8.2.2 Various types of housing facilities are available for calves and heifers.

a. Young calves have been satisfactorily housed with the producing herd in stanchion barns.
(1) This is most common in smaller herds (40 cows or fewer).
(2) As herd size increases, illness and death losses among calves housed with the milking herd tend to increase.
b. Many factors may contribute to increased losses among calves housed with milking herds.
(1) Increased contact of young calves with disease organisms caused by calves and cows is probably the major factor.
(2) Crowding, inadequate ventilation and reduced observation and care may also contribute to the problem.
(3) In larger herds, it is preferable to plan housing facilities specifically for calves and heifers.
c. House unweaned calves individually to prevent disease transfer and to prevent udder damage caused by calves sucking each other.
d. You can tie calves in individual pens or stalls. Calves also do well in individual floor-level bedded pens. Install solid partitions between pens to minimize drafts and prevent contact among calves.
e. Unweaned calves do very well in outdoor calf hutches.
(1) Hutches are covered pens with outside runs.
(2) Separate hutches to prevent contact through fences.
(3) Move the hutch to a clean, well-drained location between calves when weather permits.
f. After weaning, calves can be housed in group pens.
(1) Groups should contain calves of about the same age and size. For calves up to 8 months limit group size to 5-7 animals and provide 20-25 square feet per animal.
(2) Loose housing consists of a covered resting area and an outside run.
(3) Individual free stalls instead of a common resting area are another alternative for calves up to 4 months of age. A manure alley between rows of free stalls should be at least 6 feet wide (or wider depending on scraper width).
(4) Table 42 shows the minimum space required in various types of housing facilities for calves 4 months and older.
g. Older heifers can tolerate the stresses associated with larger groups.
(1) You can house heifers 8 months old to freshening in groups containing 10-25 animals.
(2) Older calves and heifers are usually raised in cold or modified environments such as bedded packs, free stalls, total slatted floors or self-cleaning platforms.

i. Bedded pack requires sufficient bedding; the manure packs provide warm resting surfaces, but they must usually be removed in the spring and fall.
ii. Free stalls with a solid floor require relatively small amounts of bedding, but the manure in unbedded areas must be removed once or twice a week unless the floors are slatted; and in cold barns the manure may freeze.
iii. Total slatted floors require no bedding. And required stocking rates are higher than other housing facilities. Manure stored under the building must be removed every 6-8 months and manure may freeze on slats in cold barns. The ventilation system must remove harmful manure gases. Total slatted floors may be too cold and drafty for heifers 2-6 months old.
iv. With a counter-slope floor, no bedding is required. Manure must be removed frequently unless the litter alley floor is slatted; manure will freeze. Manure-contaminated runoff from unroofed litter alleys must be properly handled. Animals may become dirty if stocking rate is too low. A counter-slope floor is not recommended for bred heifers during their last 3 months of pregnancy.

8.2.3 Proper management is necessary in any system.

Poor management can make the best housing facility a failure. Some management practices also change with animal size and maturity.

a. Observe animals to monitor their growth and health. Limit group size to reduce crowding and to make observation easier.
b. Keep calves less than 2 months old in dry, draft-free facilities and minimize their exposure to disease organisms.
   (1) Keep hutches, pens and floor-level stalls dry.
   (2) Add fresh bedding as necessary to keep calves dry.
c. Well-planned facilities can reduce time and labor required for cleaning, feeding, observation and treatment.
d. Eliminate daily hauling and reduce feeding time by storing at least 1- or 2-week supply of feed near the feeding area.
   (1) Feed may be stored in the same structure where animals rest, but avoid feeding in the resting area.
   (2) Feeding in the resting area increases manure accumulation and more bedding will be required to keep animals dry and clean.
e. Consider systems to mechanically remove manure.
f. Separate animal treatment areas (hospital stalls) from the small-calf housing facility.
g. Maternity pens should be nearly square and contain about 150-200 square feet.
   (1) One pen for every 25 cows is adequate.
   (2) Clean and provide fresh bedding in the maternity area before each use.
   (3) Locate maternity pens where observations and milking are convenient.
h. Restraining facilities make artificial insemination, pregnancy testing, treatment and examination convenient and safe.

8.2.4 Cleanliness and sanitation are important.

a. Cleanliness can reduce the incidence of calf diseases and help control flies. Proper sanitation requires:
   (1) Periodical manure removal.
   (2) Sanitizing areas, pens, or hutches between each calf crop.
   (3) Letting pens dry out or "rest" between each use.
b. Hutches, pens and floor-level stalls must be properly bedded.
   (1) Add fresh bedding as needed to keep calves dry.
   (2) Remove manure daily from elevated stalls.
   (3) Sanitize individual pens, stalls or hutches and let them remain unoccupied for a week or more between calves.
   (4) Move hutches to an unused location when the manure pack is not frozen to help break the disease cycle.
c. When calves are 3-5 months of age remove the bedded pack in the resting area twice per month in "warm" barns and twice per year in "cold" environments. Remove manure at least twice a week from alleys and feeding areas of free-stall or loose housing barns. You may have to remove manure more often in cold environments to prevent freezing.

8.2.5 Provide adequate space for animals.

a. The number of replacement animals to be housed is determined by the number of milking cows and bred heifers.
b. As herd size increases, replacement numbers also increase.
c. Increasing herd size without expanding facilities for replacement results in crowded conditions.
d. Injury and disease also increase under crowded conditions.
e. Table 43 shows the average number of animals for different herd sizes assuming only heifer calves are kept and that 5 percent of the calves are lost at birth.

f. Even though the figures reflect no culling, in actual practice 25 percent of the heifer calves may be lost or sold. However, the number of calves produced by freshening 2-year-olds is approximately equal to the number of heifer calves that are lost or sold.
g. Provide adequate feeding space so young stock do not have to compete for feed.
   (1) Optimum feeding space varies with the type of feed, feeding schedule, and animal size.
   (2) Table 44 shows the recommended feed space based on various ages of animals and feeding frequencies.

8.2.6 Water is essential at all times.

a. Provide at least one water space per 40 animals.
b. Dairy heifers require 1-1.5 gallons of water per 100 pounds of body weight.
c. Waterers should be heated to prevent freezing in cold or modified housing facilities.

8.2.7 You can select housing from many types of environments.

a. Replacements can be raised in several types of environments.
   (1) "Warm" housing.
   (2) "Cold" housing.
   (3) "Modified" housing.
b. A warm barn is insulated and relies on fan ventilation for environmental control.
   (1) Auxiliary heat is also required.
   (2) Some dairymen house replacements the first year in warm barns and then move replacements to a cold or modified facility.
   (3) It is more comfortable to work in than cold or modified environmental buildings.
   (4) It is more expensive to build than the other types.
   (5) Freezing is not a problem.
   (6) Ventilation systems must be properly operated and maintained.
   (7) Fuel required to maintain temperature.
   (8) Insulation helps cool the barn during the summer.
   (9) Excellent sanitation is critical.
c. Cold housing facilities are usually uninsulated and utilize natural ventilation.
   (1) Small calves are often kept in an enclosed building or hutch until after they are weaned and are then moved to a building open on the south side.
   (2) It is less expensive to build than warm or modified housing.
   (3) Freezing can make manure handling more difficult.
   (4) Waterers must be heated.
   (5) Frostbite of small calves may be a problem.
   (6) More feed is needed for animals to maintain body heat.
   (7) The operator must dress for cold weather.
   (8) Moisture condenses on interior surfaces during cold weather.
d. A modified environment facility is insulated and temperature is regulated by natural ventilation.
   (1) The building temperature fluctuates with changes in outside temperature.
   (2) Building costs are medium because insulation is required.
   (3) Manure freezes occasionally.
   (4) Insulation helps keep barn cooler during hot weather.
   (5) The natural ventilation system must be properly managed.
   (6) There is less ceiling condensation than in uninsulated barns.
   (7) It requires heated waterers.

8.2.8 Select proper ventilation.

a. Natural ventilation.
   (1) Natural ventilation is generally used in cold or modified environment buildings.
   (2) During the summer, wind currents provide the force for air exchange and, during the winter, the "chimney effect" also helps air movement.
   (3) Natural ventilation designs incorporate sloping ceilings and openings under the eaves and at peaks.
      i. Size of ridge openings increases as building width increases.
      ii. Adjustable doors under the eaves and/or at the peaks adjust air flow and can prevent snow from blowing in.
   (4) Large sidewall panels permit cross ventilation during warm weather.
b. Mechanical ventilation.
   (1) Fan ventilation systems must be carefully planned.
   (2) Buildings must be well-insulated and stocked to design capacity.
   (3) A ventilation system must provide a well-distributed, continuous, variable air flow tailored to the specific building.
   (4) Properly designed inlets allow fresh outside air to be evenly distributed throughout the structure.
   (5) Mechanical ventilation systems in calf barns should be designed to provide a minimum, continuous exchange of air.
   (6) Because this is difficult to accomplish, an alternative method based on the number of air changes per hour in the structure has proved effective if animal stocking rates do not vary widely.

i. Fans must provide a continuous air flow of 4 air changes per hour during cold weather.
ii. At some pre-set temperature, the air flow is increased to approximately 8 air changes per hour.
iii. At a still higher temperature, the air flow increases to approximately 12 air changes per hour.
iv. During the summer fans must provide 20 air changes per hour.

8.2.9 To raise healthy replacements with the potential for high production, carefully plan the environment in which replacements are raised.

a. Provide adequate space for water, feed, resting and exercise.
b. The best facility is not better than the manner in which it is managed.
c. Well-planned facilities let dairymen use their time and labor efficiently to produce healthy replacements.

8.3 Supplementary Materials

a. Transparency masters—**See Appendix**
   (1) Feeder-Space Requirements
   (2) Minimum housing space requirements
b. Slides
c. References
   (1) Brevik, T., A. Bringe. *Controlled Environment Housing for Dairy Calves* University of Wisconsin-Extension, March 1981. A2578.
   (2) Brevik, T., A. Bringe. *Uninsulated Housing for Dairy Calves.* University of Wisconsin-Extension, March 1981, A2576.
   (3) Brevik, T. *Ventilating Calf Barns.* University of Wisconsin-Extension, July 1980. A2704.
   (4) Brugger, M.F., L.A. Brooks. *Ventilation of Dairy and Other Livestock Buildings.* University of Wisconsin-Extension, June 1979. A2812.
   (5) Hoard, W.D. *Hoard's Dairyman Calf Care and Raising Young Stock.* Fort Atkinson, WI: W.D. Hoard and Son, Co., 1979.
   (6) Midwest Plan Service. *Building Plans.* Ames, Iowa: Iowa State University, 1982.
   (7) Brevik, T., H. Larsen, A. Bringe, R. Vilstrup, G. Krueger. *The Calf Hutch-Building and Using.* University of Wisconsin-Extension, October 1981. A2823.

8.4 Check-Out Activities

a. Provide student with the following exercise:

T F 1. Since the number of calves in a facility varies, mechanical ventilation systems must be designed for several stocking rates.
T F 2. Calves and heifers raised in a poor environment may never reach their genetic potential for milk production.
T F 3. Young calves should never be housed with the producing herd.
T F 4. Calves should be raised in larger groups (12-14) to permit easier management.
T F 5. Well-planned housing can save time and labor.
T F 6. Younger heifers can withstand stress associated with larger groups better than older heifers.
T F 7. Feed should be stored in a clean, dry place well away from the feeding area.
T F 8. Calves should be grouped on the basis of age and size.
T F 9. Feeding in the resting area reduces massive accumulation and bedding requirements.
10. Poor _____ can make the best housing facility a failure.
11. As herd size increases, replacement numbers will _____.
12. _____ can reduce the incidence of calf diseases.
13. Dairy heifers require 1-1.5 gallons of water per _____ pounds.
14. List three environmental factors that need to be considered when planning housing for calves and heifers. _____
_____

a. "Warm" barns
b. "Cold" barns
c. "Modified" barns

15. ____Waterers must be heated.
16. ____Least expensive to build.
17. ____Freezing is not a problem.
18. ____Insulation helps cool barn during hot weather.
19. ____Frostbite of small calves may be a problem.
20. ____Operator must dress for cold weather.
21. ____More feed is needed for animals to maintain body-heat.
22. ____Most expensive to build.
23. ____Freezing of manure may be a problem.
24. ____Medium cost to build.

Answers

1. True
2. True
3. False
4. False
5. True
6. False
7. False
8. True
9. False
10. Management
11. Increase
12. Cleanliness
13. 100
14. a. Adequate space
    b. Fresh air
    c. Dry, draft-free resting area
    d. Maintaining sanitary conditions
    e. Adequate space for feed and water
    f. Space and facilities for grouping by size or age
15. b and c
16. b
17. a
18. a and c
19. b
20. b
21. b
22. a
23. b and c
24. c

b. Discussion questions
   (1) Why are there increased losses among calves when housed with large milking herds?
   (2) Why should unweaned calves be housed individually?
   (3) What type of housing should be used for older heifers? Why?
   (4) What is natural ventilation?
   (5) What is meant by "warm" housing, "cold" housing, and "modified" housing?

APPENDIX
Transparency Masters

Table 4. Degree of artificial insemination and effect on milk production

Amount of A.I.	Milk Production (lb/year)	Increase in milk production above herds using all natural service (lb/year)
All natural service	13,973	--
All cows artifically inseminated	15,255	1,282
All cows and heifers artifically inseminated	16,080	2,107

Table 3. Surplus heifers in a 100-cow herd

Heifers born[1]	Survival rate, %	No. heifers raised birth to freshening	Replacement rate 15%	25%	35%
			(Heifers for voluntary culling, herd expansion or sale)		
	Calves saved from cows only				
45	90	40	25	15	5
45	80	36	21	11	1
45	75[2]	34	19	9	1
	Including calves from freshening heifers[3]				
55	90	50	35	25	15
55	80	44	29	19	9
55	75[2]	41	26	16	6

[1] In a 100-cow herd, about 90 calves are born per year, half of which are heifers.

41

[2] Average survival rate from birth to freshening.

[3] With twenty 2-year-olds and 100 cows, total calf crop is 110 calves, half of which are heifers.

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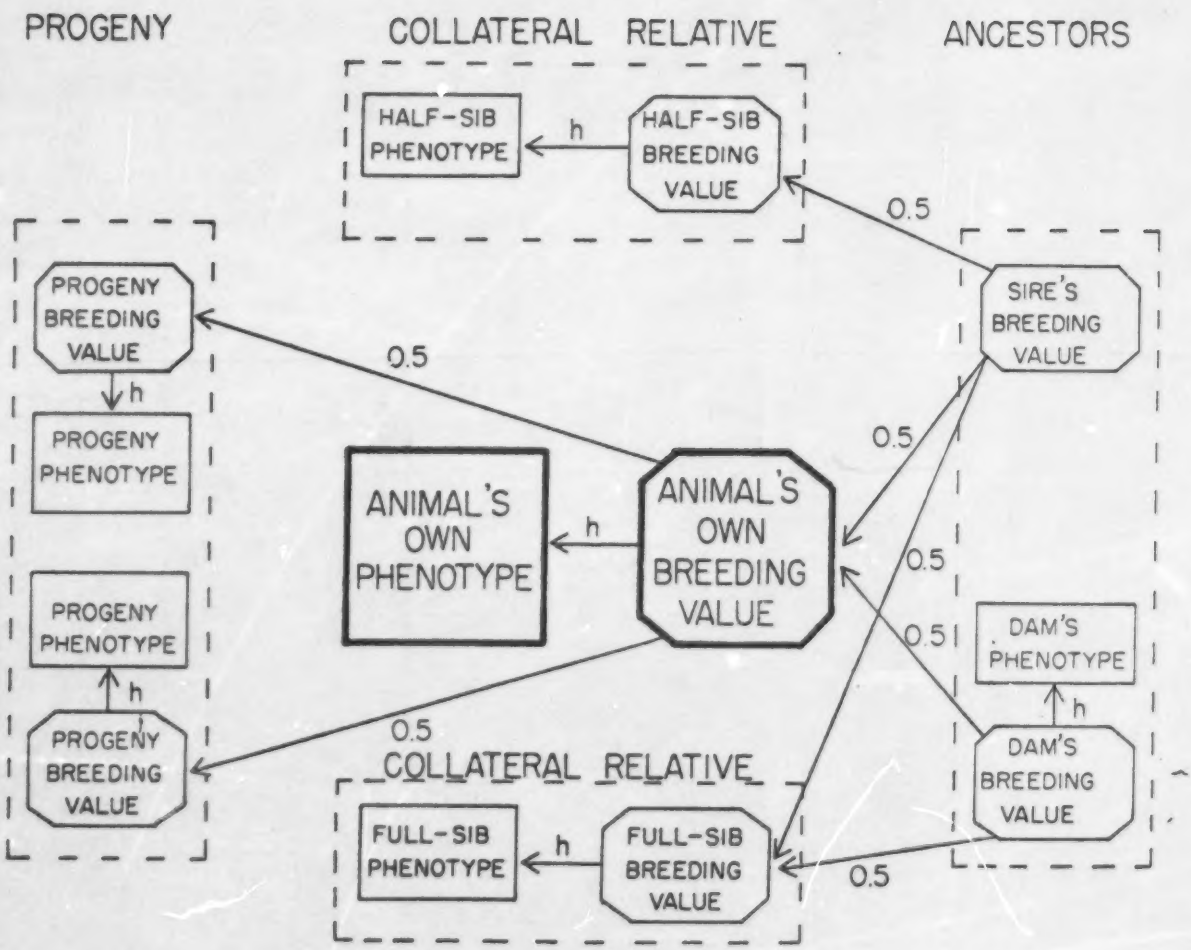

Diagram showing relationship of various sources of information to an animal's breeding value.

Table 8. Nutrient requirements of dry cows[1/2/]

Weight	Energy		Crude protein	Calcium	Phosphorus	Vitamin A
	NE_1	TDN				
Lb	Mcal	Lb	Lb	Grams		I.U.
1,200	11.7	11.4	1.9	33	24	41,000
1,400	13.2	12.8	2.1	39	27	48,000
1,600	14.5	14.1	2.3	43	31	55,000
	Mcal/lb					I.U./lb
Ration composition	0.55-0.61	55-60	11-12	0.37	0.26	2,115

[1/] 1978, National Research Council, Nutrient Requirements of Dairy Cattle. Increase by 20% to provide for growth of 2-year-olds. For a group of dry cows, feeding 12% crude protein and increasing TDN to 63% will provide for growth and conditioning.

[2/] Dry matter basis and average intake for dry cows.

Table 5. Effect of dry period on milk production in next lactation

Days Dry		Difference in milk production from herdmates (lb/year)
5-20		-1289
21-30		-629
31-40		-156
41-50		+189
51-60	Recommended range	+298
61-70		+313
71-80		+159
81-90		+63
Over 90		+107

1/ Varies with cow condition and level of production. A 6-week dry period is adequate for average producers. Young cows and high producers need 8 weeks.

Table 9. Example dry cow rations [1].

Feedstuff [2]	Alfalfa plus corn silage	Alfalfa plus oatlage	Alfalfa plus grass hay	Alfalfa plus cornstalks
	Lb dry matter			
Alfalfa (17% C.P., 58% TDN)	11.5	6	7	13
Corn stalks (6% C.P., 45% TDN)				10
Corn silage (8% C.P., 68% TDN)	11.5			
Oatlage (12% C.P., 57% TDN)		20		
Grass hay (8% C.P., 52% TDN)			18	
Corn [3] (10% C.P., 88% TDN)				3
Protein supplement (49% C.P., 84% TDN)			1	
Total	23	26	26	26
	Oz			
Mineral [4] (20-24% Ca, 18% P)	1.5	1.0	1.0	1.0
Trace mineral salt [5]	1.0	1.0	1.0	1.0

[1] Increase protein and energy to provide for growth of young cows and to condition thin cows.
[2] Forages may be fed as air-dried or silage (lbs. as fed x %DM = lbs. DM).
[3] Corn dry matter can be supplied from air-dry or high-moisture corn.
[4] A supplemental source of vitamins A, D and E is recommended.
[5] In selenium-deficient areas, provide selenium in salt or from another source.

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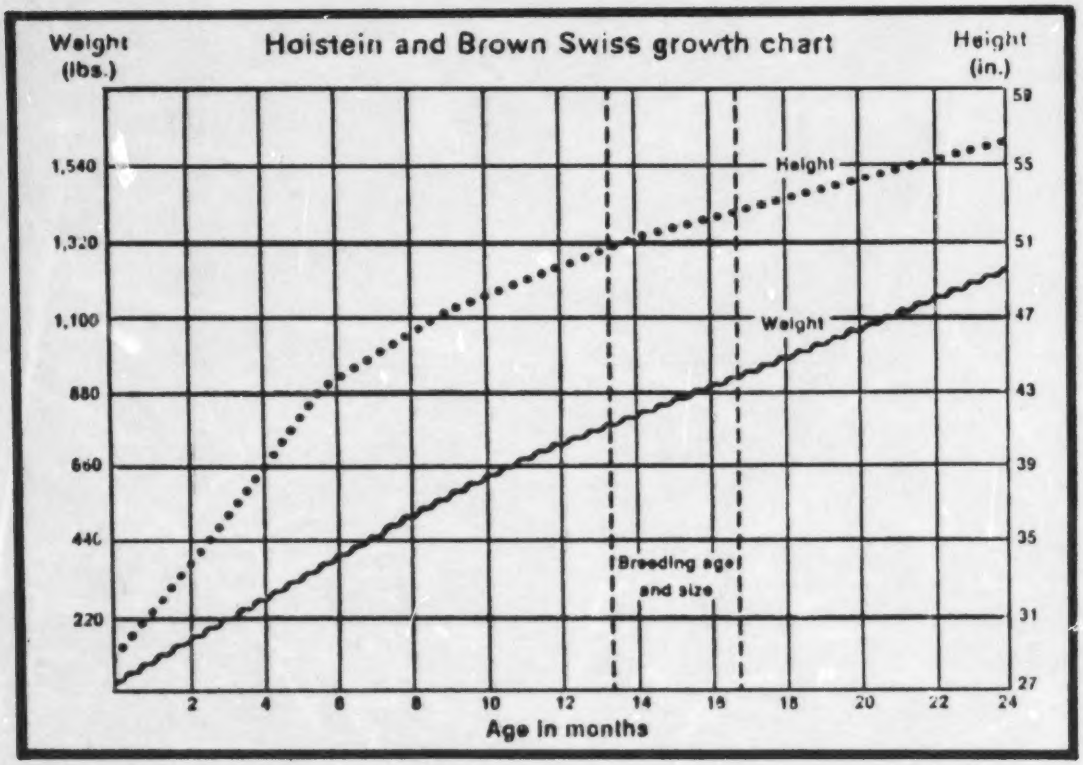

Weight (lbs.)
Holstein and Brown Swiss growth chart
Height (in.)
1,540
1,320
1,100
880
660
440
220
59
55
51
47
43
39
35
31
27
Height
Weight
Breeding age and size
2
4
6
8
10
12
14
16
18
20
22
24
Age in months

REPRODUCTIVE DISEASES			OTHER DISEASES		
DATE	CONDITION	TREATMENT	DATE	CONDITION	TREATMENT

PRODUCTION RECORDS

AGE	DAYS IN MILK	MILK — LBS. ACTUAL	MILK — LBS. M. E.	TEST	FAT — LBS. ACTUAL	FAT — LBS. M. E.

COMMENTS, NOTES & MISCELLANEOUS

JAN. | FEB. | | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC.

REG. No. | DATE OF BIRTH | BIRTH WEIGHT | CONDITION AT BIRTH

REG. No. | TATTOO OR EAR TAG — RIGHT — LEFT | CALFHOOD VACCINATION — NO. — DATE | RUMEN MAGNETS

Lesson 2

REG. No. | DEHORNED | EXTRA TEATS REMOVED | DATE & REASON FOR REMOVAL FROM HERD

MASTITIS & UDDER HEALTH					BREEDING RECORD						CALF RECORD		
RF	LF	LR	RR	TREATMENT	HEAT DATES	DATE BRED	SERVICE BULL	PREG. CHECK	DATE DUE	DATE FRESH	SEX	NAME OR NO.	CALF DISPOSAL

Table 10. Calf Mortality by difficulty of birth category[1/]

Calving category	% of calvings in category		Calf mortality (%) within 48 hours	
	Heifers	Cows	Heifers	Cows
Unassisted	45	79	8	6
Easy pull	30	15	10	8
Hard pull	14	3	35	24
Jack needed	7	1	55	66
Veterinarian needed	4	1	48	65
Total	100%	100%	17%	8%

[1/] North Carolina State University

ABNORMAL BIRTH POSITIONS

CALF UPSIDE DOWN. A veterinarian will usually turn the calf. Occasionally, such a calf must be delivered backward.

HEAD BENT BACK. If the veterinarian can push the calf back into the cow, he often can bring the head into position.

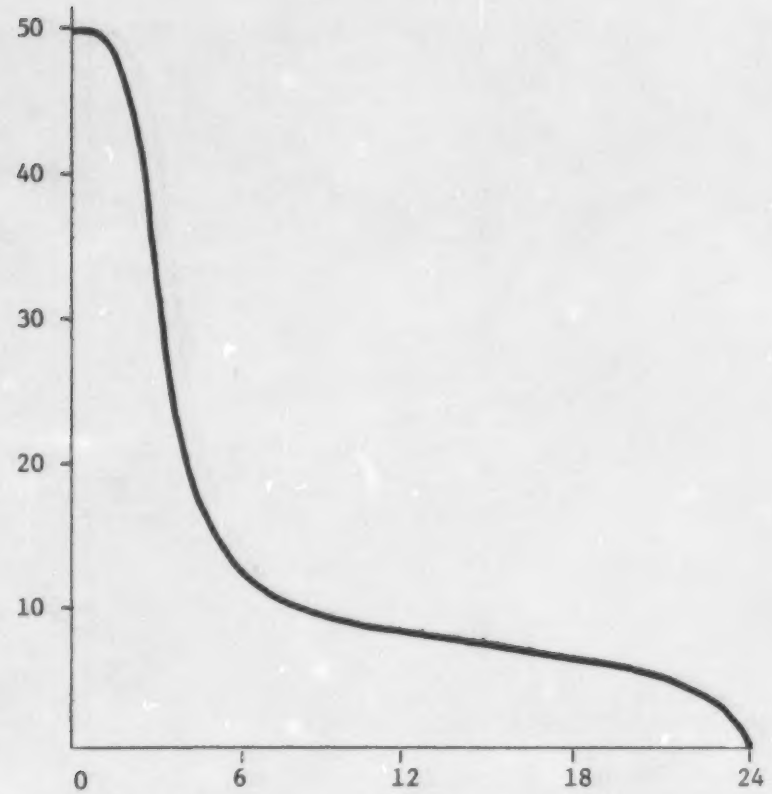
FORELEG RETAINED. In this presentation, the retained leg must be brought forward joint by joint so the calf can be delivered.

BACKWARD—UPSIDE DOWN. The calf must be turned in the uterus until it assumes the normal position for delivery.

CALF BACKWARD. Veterinarians try to straighten hindlegs of calf found in this position, then deliver calf backward.

HINDLEGS FORWARD is a serious abnormal position if delivery is far advanced. Fetus frequently must be dismembered.

Hoard's Dairyman



	Birth		
	0.5	12	24
Feeding no.	1	2	3
Amount fed (% of body weight)	4-5	4-5	4-5
	Colostrum	Transitional milk	Transitional milk

Recommended feeding schedule for newborn calves improves passive immunity

Key Words -- Introducing Tables 11, 12

Key Words: (to define, explain)

Colostrum

Transitional Milk

Immunoglobulins

Passive Immunity

Feeding Colostrum

Transitional Milk

Sour Colostrum

Whole Milk

Skim Milk

Liquid Whey

Milk Replacers

Feeding Methods:

--Age at Weaning

--Limited Milk Feeding
(5-8 wks. age)

--Early Weaning
(21-24 days age)

--Frequency of Feeding
Discuss Pros and Cons of:

--Once a day

--Twice a day

--Three times a day

Table 11. Composition of colostrum, transitional milk and whole milk[1/]

Item	Milking number (cows milked twice daily) 1	2	3	4	5	11
	Colostrum[2/]		Transitional milk			Whole milk[3/]
Total solids, %	23.9	17.9	14.1	13.9	13.6	12.9
Total protein, %	14.0	8.4	5.1	4.2	4.1	4.0
Casein, %	4.8	4.3	3.8	3.2	2.9	2.5
Immunoglobulins, %	6.0	4.2	2.4	0.2	0.1	0.09
Fat, %	6.7	5.4	3.9	4.4	4.3	4.0
Lactose, %	2.7	3.9	4.4	4.6	4.7	4.9
Minerals, %	1.11	0.95	0.87	0.82	0.81	0.74
Specific gravity	1.056	1.040	1.035	1.033	1.033	1.032

1/University of Minnesota.

2/Colostrum also contains more vitamins than whole milk.

3/Milk is legally saleable after 5 days.

Table 12. Major types of immunoglobulins (Ig) and their functions

Type	% of total Ig	Provides immunity against:
IgG	80-86	Systemic infections
IgA	7-10	Intestinal infections
IgM	7-10	Systemic infections

Table 17. Limited whole milk plan for twice a day feeding[1/]

Age (days)	Type of milk	Calf birth weight					
		50 lbs.		75 lbs.		100 lbs.	
		Lbs per		Lbs per		Lbs per	
		Feeding	Day	Feeding	Day	Feeding	Day
0-5	Colostrum and transitional milk	2-2.5	4-5	3-4	7-8	4-5	8-10
6-weaning[2/]	Whole milk	2-2.5	4-5	3-4	7-8	4-5	8-1

[1/] Offer starter at 5-7 days of age. Calves weaned at 5-8 weeks of age.

[2/] Calves should consume starter at a rate of 1% of body weight before weaning.

Table 19. Milk replacer (MR) plans for twice a day feeding

Age (days)	Feeding system	Per Feeding Based on birth weight of: 50 lbs		75 lbs		100 lbs	
0-5	Colustrum and transitional milk	2 - 2.5 lb		3-4 lb		4-5 lb	
		MR	Water	MR	Water	MR	Water
		----------lbs----------					
6-14	Milk replacer[1/][2/][3/]	0.2	1.8	0.3	2.7	0.4	3.6

1/ Follow manufacturer's recommendations.

2/ May feed whole milk to 14 days of age, then gradually change to a milk replacer.

3/ Contains 9 parts water, 1 part dry milk replacer (10% solution).

4/ Contains 7 parts water, 1 part milk replacer (12% solution).

Milk Replacer

Guaranteed Analysis

Crude Protein	(Min.) 22.0%
Crude Fat	(Min.) 10.0%
Crude Fiber	(Max.) 0.5%
Vitamin A—Not less than	15,000 IU/Lb.
Vitamin D_3—Not less than	3,000 IU/Lb.

Adequate Level
Minimum
Recommended
Acceptable after 14 Days of Age

Ingredients

Dried skimmed milk, dried whey, casein, animal fat preserved with BHA, soy protein concentrate, methionine, vitamin A supplement, D-activated animal sterol (source of vitamin D_3), vitamin E supplement, thiamine hydrochloride, niacin, ascorbic acid, calcium carbonate, dicalcium phosphate, magnesium oxide, zinc oxide, manganese sulfate, iron carbonate, copper sulfate, ethylene diamine dihydriodide, cobalt carbonate, sodium selenite and artifical flavor.

Milk Protein

Source of Milk Sugar

Plant Protein (source of increased fiber level)

Sulfur Containing Amino Acid

Vitamin C

B-Vitamin

Source of Iodine

Use as directed on back of label.

Milk Replacer

Guaranteed Analysis

		Adequate Level Minimum Recommended Acceptable After 4 Days of Age
Crude Protein, not less than	22.0%	
Crude Fat, not less than	10.0%	
Crude Fiber, not more than	0.25%	
Vitamin A, not less than	20,000 U.S.P. Units/Lb.	
Vitamin D_3, not less than	5,000 U.S.P. Units/Lb.	
Vitamin E, not less than	20 U.S.P. Units/Lb.	

Ingredients

Dried Skimmed Milk, Dried Whey, Dried Whey Product, Dried Milk Protein, Animal Fat (preserved with BHA and Citric Acid), Lecithin, Vitamin A Palmitate, D-Activated Animal Sterol (Source of Vitamin D_3), Vitamin E Supplement, Thiamine, Pyridoxine Hydrochloride, Folic Acid, Vitamin B_{12} Supplement, Choline Chloride, Sodium Silico Aluminate, Manganese Sulfate, Zinc Sulfate, Iron Sulfate, Copper Sulfate, Cobalt Sulfate, Ethylenediamine Dihydriodide and Sodium Selenite.

Use as Directed

Source of Milk Sugar

Milk Protein

Aid Fat Digestion

Vitamin A

B-Vitamin

Animal Fat

Source of Iodine

Milk Replacer

Guaranteed Analysis

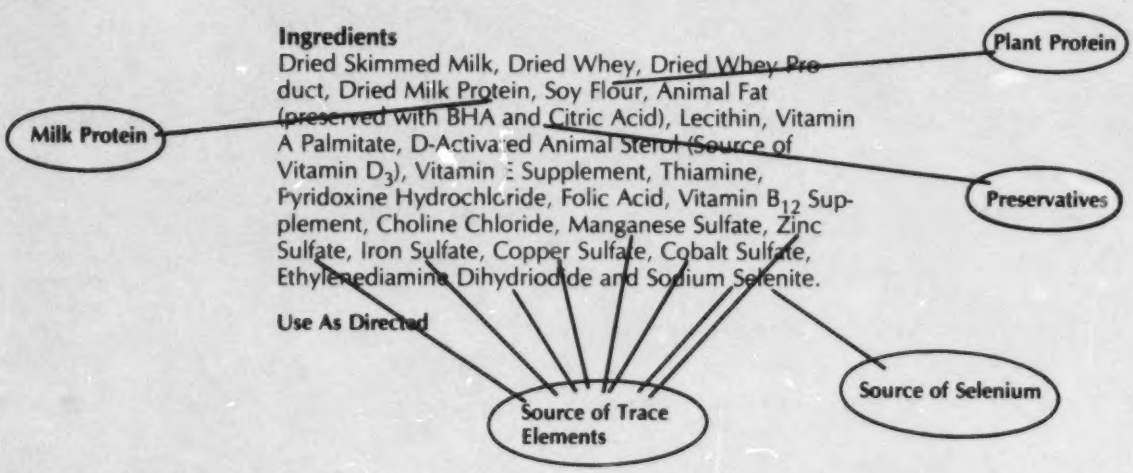
Crude Protein, not less than	24.0%
Crude Fat, not less than	10.0%
Crude Fiber, not more than	1.0%
Vitamin A, not less than	20,000 U.S.P. Units/Lb.
Vitamin B_3, not less than	5,000 U.S.P. Units/Lb.
Vitamin E, not less than	20 U.S.P. Units/Lb.

Adequate Level
Minimum
Recommended
Acceptable After
21 Days of Age

Ingredients

Dried Skimmed Milk, Dried Whey, Dried Whey Product, Dried Milk Protein, Soy Flour, Animal Fat (preserved with BHA and Citric Acid), Lecithin, Vitamin A Palmitate, D-Activated Animal Sterol (Source of Vitamin D_3), Vitamin E Supplement, Thiamine, Pyridoxine Hydrochloride, Folic Acid, Vitamin B_{12} Supplement, Choline Chloride, Manganese Sulfate, Zinc Sulfate, Iron Sulfate, Copper Sulfate, Cobalt Sulfate, Ethylenediamine Dihydriodide and Sodium Selenite.

Use As Directed



Grain Starter - Complete Starter

Table 27. Nutrient specifications for "grain starters" and "complete starters"

Nutrient (D.M. basis)	"Grain starter"[1] Range Low	High	"Complete starter"[2] Range Low	High
Energy: TDN, %	76.0	78.0	70.0	74.0
Crude protein, %	15.0	20.0	15.0	18.0
Ether extract, %	2.5	5.0	2.5	5.0
Crude fiber, %	2.0	7.0	8.0	15.0
Calcium, %	0.4	0.6	0.4	0.6
Phosphorus %	0.3	0.4	0.3	0.4
Vitamin A, IU/lb	750	2000	750	2000
Vitamin D, IU/lb	150	2000	150	1000

[1]Offer free choice with or without forage

[2]Offer free choice without additional forage

Table 28. Example "grain starters"

Ingredients (air dry basis)	Grain starters[1]							
	1	2	3	4	5	6	7	8
	%							
Corn (coarse ground)	41	37	35	35	45	21	32	46
Oats (crimped, crushed)	35	30	22	22	27	20	20	30
Wheat bran						15	10	
Soybean meal	15	25	30	25	20	11	15	21
Linseed						10		
Corn distillers dried/solubles							15	
High-quality alfalfa meal						5		
Dried whey	5		10	10		10		
Molasses		5		5	5	5	5	
Ca, P supplement	2	2	2	2	2	2	2	2
Trace mineral salt	1	1	1	1	1	1	1	1
Crude protein, %	15	17.9	20.2	18.1	16.3	17.2	17.6	16.9
Crude fiber, %	6.0	6.0	5.4	5.1	5.5	6.2	6.7	6.0

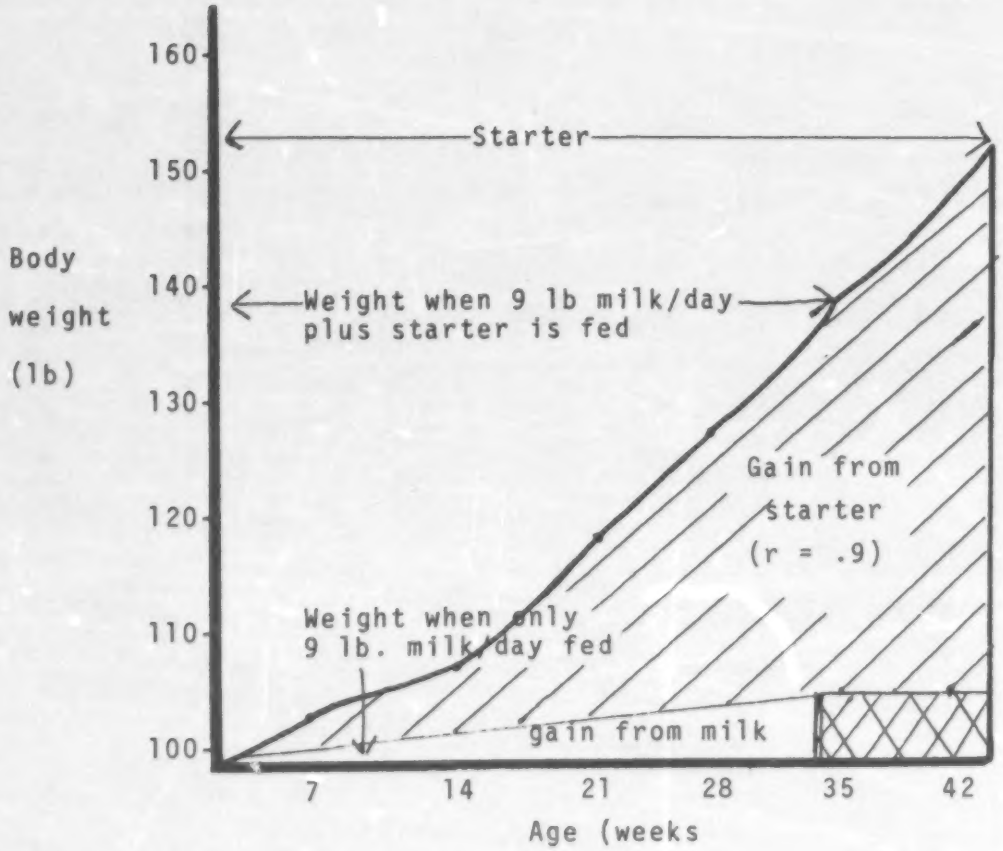
[1]These grain starters have been successfully used in calf-raising programs. The per cent crude protein in a starter depends on age at weaning. For early weaning, feed starters containing 18-20% protein and which contain some high-quality protein, such as whey powder or dry skim milk. From 300 to 1000 I.U. of vitamin D and 2000 I.U. of vitamin A per pound of grain starter are recommended.

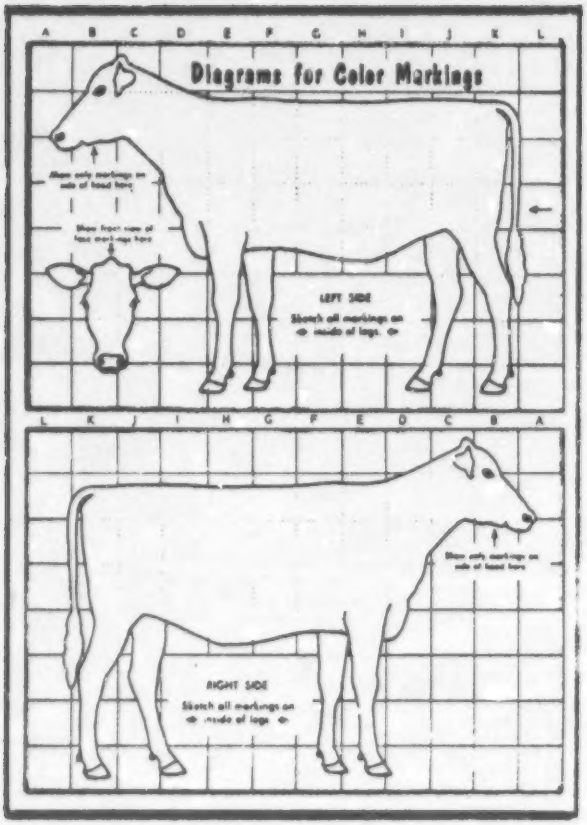
Table 29. Example "complete starters"[1]

Ingredients (air dry basis)	Complete starter rations							
	1	2	3	4	5	6	7	8
	----------%----------							
Beet pulp		25		25		25		25
Corn (coarse ground)	30	25	28	22	30	13	20	29
Oats (crimped, crushed)	29	20	25	19	20	13	15	19
Wheat bran						10	8	
Soybean meal	13	19	19	20	15	14	11	19
Linseed meal						10		
Corn distillers dried/solubles							11	
High-quality alfalfa meal	25	5	25	5	25	5	25	5
Dried whey						7		
Molasses		3		6	6	6	7	
Ca, P supplement	2	2	2	2	2	2	2	2
Trace mineral salt	1	1	1	1	1	1	1	1
Crude protein, %	16.1	16.2	18.1	16.3	16.5	18.2	17.0	16.3
Crude fiber, %	11.1	10.5	11.0	11.0	10.8	11.8	11.7	11.0

[1]These complete starters may serve as the total dry supplement to the liquid feed for calves from birth to 4 months of age. For very early weaning, complete starters which contain 16-18% crude protein and whey powder or dry skim milk have some advantages. From 300 to 1000 I.U. of vitamin D and 2000 I.U. of vitamin A per pound of complete starter are recommended.

Figure 7. Weight gain depends on starter intake




A B C D E F G H I J K L
Diagrams for Color Markings
LEFT SIDE
L K J I H G F E D C B A
RIGHT SIDE

Scours

1. Mechanical
2. Nutritional
3. Organism

Follow with:

1) a simple electrolyte formula
copy straight from guide

2) a complete electrolyte formula
copy straight from guide

Table 40. Vaccines to consider for routine use

Disease	Type of vaccine	Initial immunization	Booster
Brucellosis[A]	Live culture	Heifers, 2-6 months old	No
Clostridium septicum (Blackleg)	Bacterin-Toxoid	Single Injection of combined vaccine	Repeat in 2 months if calves first injected when less than 6 months of age
Clostridium septicum (Malignant edema)	Bacterin-Toxoid		
Leptospirosis[A]			
L. pomona*	Bacterin	Single injection of vaccine contining five strains is recommended	Annually (all strains) Booster 6 months after initial injection in problem herds
L. hardjo*	Bacterin		
L. grippotyphosa	Bacterin		
L. canicola	Bacterin		
L. icterohemorrhagiae	Bacterin		
Bovine Rhinotracheitis[ADP]	M.L.V.	Nasal spray or single injection (8-14 months preferred). Nasal spray can be used in young calves if repeated in 8 months	Annually for maximum protection
Bovine Parainfluenza-3[P]	M.L.V.	Nasal spray or single injection	Annually for maximum protection
Bovine Virus Diarrhea[AD]	M.L.V. or Killed Virus	Single injection (8-14 months preferred) Two injections	Annually for maximum protection
Haemophilus somnus[P]	Bacteria	Two injections	Usually not required

A = abortion

D = diarrhea

P = pneumonia

*The most common strains causing problems in Wisconsin cattle.

Feeder-Space Requirements

	Age (Months)				
	3-4	5-8	9-12	13-15	16-24
	Feeder space (inches per animal)				
Silage bunk or hay rack					
Feed always available	4	4	5	6	6
When all animal feed at once	12	18	22	26	30
Feeder-head opening	8	9	10	11	12

Minimum Housing Space Requirements

Housing Type	Age (Months) 3-4	5-8	9-12	13-15	16-24
	(Square feet per animal-except freestall)				
Resting area & paved outside lot	20 30	25 35	28 40	32 45	40 50
Solid floor-total confinement	20	25	30	40	60
Slatted floor-total confinement	11	12	13	17	25
Freestall and	2'x4'6"	2'6"x5'	3'x5'6"	3'6"x6'6"	3'6"x7'0"
manure alley wideth	6 ft.	8-10 ft.	8-10 ft.	8-10 ft.	8-10 ft.